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CONTENTS
APRIL 1946

TRANSACTIONS SECTION

Bendix

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Heavy loads—high speeds—heavy travel on the highways—all are the common rule of the day—and they all spell a demand for emergency braking that is a lot more than just a parking brake. Bendix*—for years recognized as the greatest name in brake engineering—has developed a new brake to more than meet these rigid requirements.

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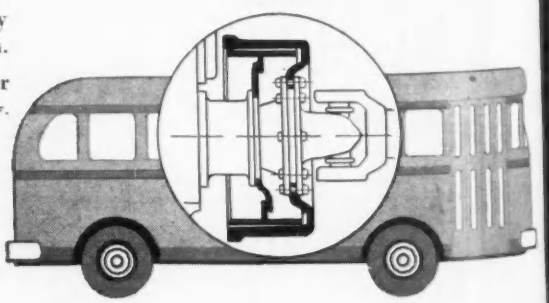

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TECHNICAL INTELLIGENCE

Traces German Defeat To Bungled Production

By W. F. Sherman

GERMAN tank-automotive engineering progress was revealed by industry and Ordnance specialists at the SAE German Engineering Evaluation Meeting in Detroit on March 4, when the inner story of these developments was disclosed for the first time. Twelve speakers, each highly specialized, were on the program at this national meeting to explain the work and findings of the technical intelligence teams which combed Europe for data important to the Allies.

The papers presented in Detroit represented the condensation of thousands of pages of reports and were illustrated by numerous slides, including photographs and charts, leading to audience comment that no series of technical papers heretofore presented has been more completely interpreted and visualized for audience or readers.

The meeting, sponsored by the Passenger Car and the Truck & Bus Activities, with the cooperation of Detroit Section, was attended by more than 300 during the morning session, 550 at the afternoon session, and 450 during the evening session. The general committee in charge of the planning and execution of the meeting was headed by L. W. Fischer, SAE Truck & Bus meetings chairman. Serving with him were SAE Vice-Presidents J. E. Hale and B. W. Keese; S. W. Sparrow, SAE Passenger Car meetings chairman; and Detroit Section's Chairman R. J. Waterbury. E. F. Petch and his Detroit Section reception committee greeted the members and their guests.

Because the war is "the greatest of all competitive enterprises," evaluation of the competitor's activities, methods, resources, organization and product is essential, Col. J. M. Colby, Ordnance Department, declared in a keynote address at the evening banquet. Search for this type of information among nations is "technical intelligence" and it was these activities and searches which formed the basis for the papers presented at the meeting.

The colonel described the sources of technical intelligence, including the use of observers in the early days of the war, the employment of technical instruction teams – after the advent of Lend-Lease – sent to all parts of the globe to train our Allies in handling new American equipment, and the later use of trained military technical intelligence teams from Ordnance on all battlefronts.

These teams supplied information on new enemy equipment and sent many samples of equipment back to the United States for test and inspection. The SAE War Engineering Board assisted in the analysis and testing of many components, Col. Colby stated.

"No new tank-automotive mechanisms of importance were revealed by their investigation," he said, "but the factual data obtained did much to offset grossly exaggerated and unfounded reports and assisted in preventing the United States development program from going off on tangents."

As the war ended, the colonel related, pressure for new developments eased and it was then that outstanding scientists and engineers from industry, with consent and cooperation of management, went to the fronts to gather information of the type revealed in the papers at this SAE session.

Modus Operandi Explained

Opening the morning meeting, General Chairman L. W. Fischer, Timken-Detroit Axle Co., introduced Lt.-Col. C. H. Corey, who discussed "Technical Investigations of German Automotive Materiel." He explained the Nazi set-up used for coordinating the Nazi armies and German industry, showed about 25 slides depicting German tanks and motor vehicles and presented a captured German movie, in color, on the launching of V-2's.

Ordnance intelligence activities in Octo-

A few items of the large exhibit of captured enemy equipment, which was made available to the SAE German Engineering Evaluation Meeting by Major-Gen. G. M. Barnes, Army Ordnance Department.

1. Maybach HL-230V-12 water-cooled gasoline engine for tanks.

2. Steel tired rubber insulated wheel from a Panther tank, copied from the Russians.

3. Rear view of the amphibious Volkswagen with a 4-cyl aircooled gasoline engine showing the shielded propeller which was raised manually when the vehicle was on land.

4. Another view of the amphibious Volkswagen.

ber, 1944, consisted of a nucleus group of 15 officers, civilians and WAC's, he said. This ultimately grew to approximately 155 personnel, of which 125 were technical investigators, and activities were carried on through CIOS, the Combined Intelligence Objective Subcommitee. For this operation, lists were prepared containing all available information about "target categories," or items on which information was desired, such as radar, artillery and weapons, vehicles, metallurgy, and so forth. These were investigated by British-Canadian-American teams as soon as the "targets" fell into Allied possession. As a result of these, approximately 800 field team reports were prepared by CIOS technical investigators.

"It is probably a fact that never before, in recorded history, has a defeated nation been so thoroughly investigated – politically, industrially and scientifically – or been the source of so much valuable technical intelligence as has Germany," he said.

All of the declassified or unclassified technical reports are being made available and can be obtained through John C. Green, Publications Board, Department of Commerce, Washington, he added.

Hitler's underestimation of the power of the opponents he had picked led initially to the setting of production schedules and mobilization plans that were inadequate, the Colonel declared. These facts were realized after the failure of the winter offensive in Russia, at the same time that the Nazis were shocked into the realization that their tanks were inferior to the Russian KV-1 and T-34, tanks – the latter completely unknown to German intelligence until encountered in battle. Hitler then gave Albert Speer the task of coordinating and increasing war production, taking the power away from the armed forces. This placed development largely, and production entirely, into the hands of industry, although the formulation of requirements and acceptance remained with the armed forces. To accomplish the production goals, Speer organized all German industrial firms into a number of Main Committees and Rings. Later a Development Commission, corresponding to each Main Committee, was set up to eliminate cross-purpose work on the part of Army, Navy and Air Force.

Why Transportation Failed

As a result of concentrating almost exclusively on the development of armored fighting vehicles to the exclusion of regular motor transport, the German transportation system was depleted and early failed, a contributing factor in the weakening of German defense in the later days of the war.

Technical papers were presented in five groups at the morning, afternoon and evening sessions. Powerplants, power trains, running gear and chassis, fuels and lubricants, and highways were the subjects covered in these papers.

Powerplants selected by Germans for development to be used in military vehicles were gasoline engines, a choice made by the General Staff early in the 30's on the advice of the German oil industry. One continuous and uninterrupted development was that of the Maybach engine. On the other hand, most heavy transport vehicles were powered with water-cooled diesel engines. However, following the 1942 winter campaign in Russia, a strong movement was initiated to convert both light and heavy trucks to air-cooled diesel engines. Although only a few conversions had been effected, this movement represented a major trend in Germany since 1945. Interest in direct injection was strong but only one such engine was scheduled for early production use.

These powerplant facts were revealed by Maurice A. Thorne, General Motors Corp., in his paper on "German Army Vehicle Engines."

All evidence indicates that German vehicle engines were generally inferior to our own in point of dependability and relative freedom from troubles, Mr. Thorne said. This was substantiated by Col. Corey's statement that American Army transport vehicles were highly regarded by the Germans. Although German vehicle design was frozen in 1939, Nazi armies and supply lines utilized an infinite variety of equipment, including a large quantity of looted vehicles which the Nazis had picked up all over Europe. Keeping

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Analysis of German military engineering, which transformed the famed Prussian Uhlan troops of World War I into a mighty motorized fire power which nearly spelled our defeat, traces an epic from near victory for the Nazis to a shambles.

American automotive engineers and Army experts condensed volumes of detailed reports to highlight their personal observations in making these first disclosures to an SAE audience.

■

this equipment rolling "must have been a first-class nightmare for the parts and service people," Mr. Thorne observed.

The German radiator and oil cooler industry was debunked by Fred M. Young, Young Radiator Co., in his analysis, made after he had visited all of this industry's plants in liberated areas and even those outside the American sphere. The Germans were handicapped by lack of proper materials so they engaged in development of substitute products instead of making normal refinements in prewar designs. An exception was the aluminum radiator used in aircraft applications which incorporated much excellent workmanship, although bonding methods were crude.

In the aluminum radiator, tubes and fins were joined by submerging in a bath of aluminum-base lacquer, Mr. Young declared. Inasmuch as lacquer is an insulating medium, rather than a conductor, heat transfer rates were low and unsatisfactory, he explained. Other bonding methods were developed but not to the point of application and production.

The Adam Opel Works were leaders in the development of radiators, machines, design and plant layout, he added.

One of the interesting developments in the assembly of aluminum radiators for aircraft was the use of atomic hydrogen arc welding, corresponding somewhat to American work with the Heli-Arc.

Most German radiators were extremely heavy, rough and crude, although incorporating excellent workmanship. Strength of the radiator itself, rather than proper mounting was relied upon, he said.

Careful attention to air flow, ingress and egress, did much to overcome radiator inefficiency, Mr. Young asserted. His paper was "German Radiators and Oil Cooler Structures and Facilities for Manufacture."

Power transmission developments were covered by two complementary papers by Lt.-Col. Ewen McEwen, assistant director, fighting vehicle design department, British Ministry of Supply, and R. R. Burkhalter, Spicer Mfg. Corp. Their papers were "The Highlights of German Transmission Design and Development" and "German Automotive Transmission Systems – Development and Design."

Col. McEwen described the practical monopoly in German tank transmission that was held by the Friedrichschafen (Zeppelin) combine and Maybach, with only a few gestures by the Nazis to support any other transmission development.

"This inbreeding of design, apart from causing heartburning among rival manufacturers and inventors, led to a certain lack of progress," the colonel declared. The transmissions he described and illustrated were complex, showed a "lavish expenditure of manhours, first-rate workmanship and extremely ingenious detail design, but an apparent inability to use simple means to an end."

Extensive use was made of all-hydraulic and vacuum-hydraulic controls with a "Mechydro" unit being prepared at the time of the German collapse, in the Maybach transmission. The Zahnradfabrik Friedrichschafen (Z.F.) designs showed more changes. All embodied the "Aphon" gear mountings, with a variety of synchronizing and selection means, including an electro-magnetic control which was under development.

Characteristic of the German transmissions was a large number of selections of forward speeds, ten being available in some cases. However, the high-gear ratios could only be used in very favorable circumstances and unusual driving skill was required to make the shifts at all in some cases.

Although gear stresses were low, many troubles plagued the German transmissions including synchromesh mechanisms that didn't work and other failures which led, in some cases at least, to unenviable reputations for unreliability.

Of particular interest perhaps to American engineers was Col. McEwen's statement: "All German tank gearbox gears were ground and there appears to have been no knowledge of shot-peening or the possibilities of improving fatigue life by the elimination of grinding. The attitude of the Maybach combine on this problem was that gearbox gears should be ground in order to obtain sufficient accuracy, and there was no evidence that this thesis had ever been seriously disputed. The use of grinding, together with low stressing, would result in an expensive unit somewhat larger than was necessary for the duty, but normally reasonably safe."

Noteworthy in the German transmissions was the generous use of ball bearings.

These German vehicle designs and their transmissions were started as early as 1926, Mr. Burkhalter declared, basing his information on captured German documents. Most of the original designs for transmissions and equipment were made under the disguise of switching locomotives. It was surprising to find German engineers responsible for the designing of components, but with no information on actual use and field results. Large production automotive companies were intentionally omitted from the prewar programs because of their foreign connec-

tions, Burkhalter declared. Transmissions used in trucks and halftracks were of conventional design but utilized some unusual features, designed mostly to improve maneuverability.

Very little development work on axles was noted except some on steering differentials. No hypoid gears were observed, according to Burkhalter. Brakes were conventional design, although an unusual self-energizing disc type brake was being used to steer track-laying vehicles.

Intense interest greeted the presentation on "Suspension and Track of German Military Track-Laying Vehicles" by Tore Franzen, Chrysler Corp. He based his data on personal interrogation of German engineers and also on observations made of captured materiel. A most important source was Dr. Ernst H. Kneipkamp, specialist in suspensions, who was deputy chief in charge of automotive research for the Nazis. Tracing the history of German tank development, he related that between 1928 and 1933 many tests were conducted at Kassan in Russia in collaboration with the Russian Army.

Suspensions Described

Details of these and following developments were shown in 32 slides which provided clear evidence of the developments of German suspension systems through the years, up to the end of the war. One of these was "The Maus" intended to weigh 200 tons, suspended on six double bogies on each side and with a track 42 in. wide on each side. Only two units were actually finished but material for a large series of these monster tanks was partly fabricated at the time the war ended.

Future design programs of the Germans consisted of an "E" series of tanks conceived by Dr. Kneipkamp in early 1942, calling for the E-10 (12 to 15 tons); E-25 (25 to 30 tons); E-50 (50 to 65 tons); E-75 (75 to 90 tons). Tentative plans were laid for the E-100 which was to be 100 to 130 tons.

The military insisted on rear drive on these vehicles in order to clean up the fighting compartment and to make the driving mechanism less vulnerable, although such construction is mechanically inferior to front drive. Another requirement called for all suspensions to be attached to the outside of the tank without any through torsion bars, to keep fighting compartments clear. Overlapping wheel construction was to be avoided by using individually sprung assemblies, and Mr. Franzen displayed schematic drawings made by Dr. Kneipkamp.

On the light tank a "squat" feature was to be introduced in which a power take-off would raise and lower the vehicle 18 to 20 in., above and below normal. Mr. Franzen revealed that John Almen's formula (GM Research) for determining deflection and stress was used by the Germans in all their early calculations.

Concluding, the author added that Hitler himself, rather than the general staff, dictated some of the designs, of which the clumsy "Maus" was a typical example.

A paper on "Observations of Various German Suspensions and Steering Gears" by R. L. Weider, White Motor Co., consisted of brief descriptions, accompanied by 25 slides. He presented a mass of detail and analyses of types of suspensions and steering gears dissimilar to the systems common to American practice. These included heavier vehicles, as well as the Volkswagen.

Confirmation of the fact that the German rubber industry had not progressed relatively as far as our own in synthetics, despite its pioneering, was given by Earl W. Glen, Goodyear Tire & Rubber Co., and assistant director, Rubber Division, CPA. This appeared to be due to the lack of cooperation between the synthetic production industry and the end-product manufacturing industry in the mid-thirties. A change in the willingness to cooperate as war approached came too late to be helpful.

Bonding Work Begun

An improved method of bonding synthetics to track blocks and bogie rollers was in process of development. This employed a new coating called Desmodur R which could be applied more efficiently than brass plating and produced a more uniform and satisfactory bond.

Desmodur R was also used as a tire cord dip and general "tackifier." Its adhesive qualities are so outstanding that samples are being brought to this country for experimentation. Mr. Glen described tires similar to our "run-flat" tires and a great deal of experimental operations, including an air-conditioned tire building plant which demonstrated that production difficulties can be eliminated with temperatures less than 18 C, with a relative humidity of less than 70%. In a laboratory at Leverkusen

turn to p. 32

Prominent Figures at SAE German Evaluation Meeting

Left to right: B. W. Keese, SAE Vice-President, Truck & Bus Activity; L. W. Fischer, general chairman; SAE President L. Ray Buckendale; J. E. Hale, SAE Vice-President, Passenger Car Activity, and a member of the general committee; inset: Col. J. M. Colby, Ordnance Department, principal banquet speaker with R. J. Waterbury, SAE Detroit Section chairman, and member of the general committee

ASA Plans Expansion

FAVORABLE attitude of the Government toward private enterprise leadership in industrial and consumer standardization was expressed in a letter from Secretary of Commerce Henry A. Wallace, recently made public by the American Standards Association.

The Department of Commerce, the secretary of Commerce believes, "can accept wholeheartedly the objectives and spirit" of the report of the Policy Committee on Standards, a group of industrialists headed by Charles E. Wilson, president of General Electric Co., and appointed by the Secretary.

"The Department," he continued, "will be delighted to see the ASA and other organizations pursue a vigorous program in the field of trade standards, and will cooperate to the fullest extent in providing both scientific and technical, and economic and marketing data which will be useful in such a program."

Including the SAE, the ASA has 94 national organizations in the membership.

The divisions of Simplified Trade Practices and Commercial Standards, Secretary Wallace revealed, will be transferred out of the National Bureau of Standards to a "more suitable status elsewhere in the Department of Commerce, in line with one of the recommendations of the Policy Committee."

The Secretary also agreed that the functions of the Bureau of Standards should be those of basic research, furnishing of facts, measurements and technical assistance in development of adequate testing methods.

Although the Policy Committee had recommended that the Department withdraw from the field of initiating and publishing standards which are voluntarily agreed to by industry groups as soon as the ASA implements itself for such functions, the Secretary demurred.

He pointed out that the Department of Commerce has a statutory responsibility to provide such activities in the interest of business, industry, and the general public.

Furthermore, he pointed out, there may arise circumstances in which the cooperation of the Department of Commerce and the Department of Justice will be desirable in order to avoid any possible misinterpretation of voluntary industry agreements on standards in relation to antitrust legislation.

To the extent the ASA reorganizes its procedures with the recommendations of the Policy Committee, "the Department is prepared to encourage the use of the facilities of the American Standards Association for the initiation, development, and publication of standards," the Secretary wrote, pointing out that the Department does not wish to compete with, or to duplicate, the services which private organizations provide.

The Department, moreover, does not wish to have voluntary industry standards misinterpreted as scientific or compulsory Government standards, he wrote.

"The Department itself does not plan, nor can it hope, to monopolize this field of activity," Mr. Wallace's letter continued. "On the contrary, it is the job of the Department, as I see it, to stimulate and assist activity by private groups in this field and

Rambling Throug

FIVE speakers addressed a record attendance at the March 1 meeting of **MILWAUKEE SECTION.** Announced as a symposium on German automotive industries, the program featured condensed reports on Germany's wartime developments in five specialized fields of automotive activity. The five speakers were part of an automotive industries group sent to Europe by the Government last fall to investigate and report on German automotive industries.

Arthur W. Pope, Jr., chief research engineer, Waukesha Motor Co., speaking on diesel and carburetor-type engines, reported that he neither expected nor found any miracle engines in Germany, but was impressed with numerous examples of fine craftsmanship. Three most significant properties, he said, were weight per horsepower, an indication of efficiency in the use of construction materials; piston speed, an index of the type of service for which the engine is suitable; and horsepower per sq. in. of piston area, an index of overall combustion chamber design. Reported trends in automotive practice were toward air-cooled engines, hardened crankshafts, inclined valves, and pushrod-operated, rather than overhead, camshafts.

Robert C. Mathewson, injection equipment specialist, American Bosch Corp., covered diesel and gasoline injection equipment, reporting advanced progress in the development of gasoline-injection pumps and production of pump and nozzle equipment for jet engines.

Wilbur F. Shurts, chief engineer, hydraulic division, Twin Disc Clutch Co., reported a lack of radically new transmission developments. Friction clutches were of orthodox design, he said, with excellent workmanship and materials, and electro-magnetic clutch transmissions were in use.

Tendency was to eliminate liquid cooling from military engines, according to Allan M. Madle, Briggs and Stratton Corp. A compromise arrangement consisting of air-cooled heads and oil-cooled jackets, he said, was still in the experimental stage. German preference is for the 2-cycle engine because of simplified construction, lower cost, and greater utilization of displacement.

Reporting on radiator-type oil coolers, Fred M. Young, president, Young Radiator Co., said that lack of copper forced the Germans to develop aluminum radiators for aircraft applications. Finned sections were formed from sheet stampings, and the assembly was welded together.

Three reasons for favoring turbine locomotives are elimination of reciprocation, increase in reliability, and greater simplicity, according to John S. Newton, assistant manager of engineering, Steam Division, Westinghouse Electric Corp., who was one of the principal speakers at the Feb. 18 meeting of the **DETROIT SECTION.**

Operating people consider the turbine locomotive as the last word in reliability and simplicity, he declared, and the job of the fireman and engineer is reduced to that of simply "opening nozzles and turning valves."

The arrival of diesel power stimulated the design of steam turbines, Mr. Newton declared, as did the introduction of electrified drives.

He expressed the belief that where coal is the most common fuel, as in eastern United States, either the steam reciprocating engine or the steam turbine has the greatest possibilities of acceptance. Therefore, steam as a source of railroad power is far from dead.

E. Blakeney Gleason, vice-president and general manager of the Gleason Works, traced the history of this machine building concern and gear supplier, with particular attention to the development of bevel and spiral gears and the hypoid development which has been of particular interest to the automotive industry.

Ladies' Night meeting of WASHINGTON SECTION, Feb. 14. James Ludy, Delaire Corp., discussed frozen foods

SYRACUSE SECTION inaugurated, on Feb. 18, a series of winter meetings to be held in Elmira for those SAE members who cannot make the trip to Syracuse. About 60 members and guests attended the meeting, which featured a talk by C. W. Terry, Aeronautical Engineering Department, Cornell University, on "Jet Propulsion." Prof. Terry covered the abilities and limitations of the jet system of propulsion in the light of what has been accomplished in the past and what may be accomplished in the future.

ST. LOUIS SECTION ladies' night meeting, Feb. 12, was an outstanding success. Consisting of a Monte Carlo night, it featured gambling with stage money,

Section Reports

attendance prizes and prizes for winners, dancing, and buffet supper. Prizes ranged from fountain pens to floor polish and motor oil, and even included six pairs of nylon toothbrushes.

Wondering, perhaps, how he could lose so much so fast on the horse-race game, Burns Dick of the St. Louis Section looks puzzled. Christy Butterworth, SAE Journal field editor, rakes in winnings in the background

Ralph Jackson, St. Louis Section chairman, receives an attendance prize at the Monte Carlo Night party

T. R. Louden, Civil Engineering and Aeronautics Department, University of Toronto, spoke on "Jet Propulsion" at **CANADIAN SECTION** meeting, Feb. 20. Prof. Louden was introduced by C. E. Tilston, Section past-chairman and past SAE councilor, and one of his former students. Illustrated with slides, his address gave a birdman's-eye view of the development of heavier-than-air flying machines from the brief flight and crash of Maxim's "queer contraption."

How horsepower and fuel economy of tractor engines are affected by octane number and volatility of tractor fuels was the subject of an instructive paper presented at the Feb. 12 tractor, industrial power and diesel engines meeting of **CHICAGO SECTION** by W. G. Ainsley, director, engineering laboratory, Sinclair Refining Co., and W. F. Strehlow, chief engineer, Tractor Division, Allis-Chalmers Mfg. Co.

Mr. Ainsley explained with the help of charts and tables the results obtained from a series of variable mixture control tests, variable speed tests and load tests and spark characteristic tests conducted under a joint project participated in by seven tractor engine manufacturers and seven oil companies. Tests were conducted by the Tractor Fuel Requirements Group under auspices of the CFR Committee of CRC, and disclosed significant trends in power output, fuel economy, knock rating and spark setting.

Mr. Strehlow supplemented Mr. Ainsley's presentation with a report on the long-existing need for a tractor fuel specification, the quantity of work which has been put into this project, and the amount which has yet to be done.

The growing importance of private carriers in our transportation system, and the vital role of design and production methods in the manufacture of truck axles, wheels, and associated parts needed for motor transport, were outlined at the T&M meeting of **CHICAGO SECTION**, March 12.

William Ott, general traffic manager, Kraft Foods Co., emphasized the high percentage of the nation's truck equipment used by private carriers, and also called attention to the danger of restrictive regulation in this field. Interpretation of classifications made at carrier hearings, he said, often work to the distinct disadvantage of private carriers. In future, he believes, there will be considerable diversion of transportation to the private carrier field because of the unfavorable rate structure of the "for hire" industry and the consequent reduction of its operating reserve.

G. C. Vanderberg, chief engineer, Axle Division, Clark Equipment Co., speaking on "Truck Chassis Trends and the Development of the Driving Units," described the steps in the production of a 1½-ton axle for commercial vehicle use, explaining in turn the historical development in design of the internal gear, the semi-floating, and the full-floating types of axles. He outlined various tests which Clark's engineering department has devised to check the several manufacturing processes, and explained that the special machinery and fixtures developed for testing and for multiple production comprised a major research and designing problem for the company. Once developed and refined, however, he reported, they greatly simplified the process of manufacture on a quantity production basis.

Rockets and reaction jet powerplants held the attention of a capacity audience and nearly 150 standees at the **METROPOLITAN SECTION'S** March 7 meeting,

continued on next page

to perform a pilot function in commercial standardization work as it has been doing for some two decades."

Thus the path is still open for any group to take its standardization problem to either the Department of Commerce, its own standardizing body, or to the ASA.

"This is the first time the Government has come forward in a move to reduce the increasing controls of Federal bureaus in the operation of business," Howard Coonley, chairman of the executive committee of ASA, said in making the announcement. A former executive of the War Production Board, and lately an adviser to the Chinese Government on standards, Mr. Coonley predicted that the technical staff of the ASA would be doubled by year's end, and reported that he had been assured of adequate industry support for the enlarged ASA area.

Three new directors will be added, he said, to provide representation on the board of consumer groups, retail organizations, and publishers.

Standardization procedures of the ASA will be speeded up to meet its prospectively increased demands. Executive committees will be named to pass on recommendations during interim stages of standardization.

Dr. P. G. Agnew, who continues as secretary of the ASA, hailed Secretary Wallace's letter, saying that the best possible standards program is the one which has the complete agreement of all interests involved. Only codes in the field of public safety and health, for example, should be legislated and even then they should be revised as advanced knowledge and new experiences are gained in any particular field.

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continued from preceding page

when Col. Donald Putt, Wright Field rocket expert, and Robert A. Cole, Wright Aeronautical Corp., presented papers on these subjects. Col. William Councill, whose transcontinental record of 4 hr, 13 min, 26 sec front-paged newspapers around the world in January, was the guest of honor and was called upon to discuss some of the aspects of his flight. Lt.-Col. J. A. O'Mara, Wright Field expert who recently returned from an overseas observation assignment, also spoke. James M. Crawford, SAE past-president and chairman of the SAE Technical Board, was one of the honored guests. Arrangements for the meeting were in the hands of F. T. Kurt, the Section's vice-chairman for aeronautics. Because of a throat ailment he called upon Chairman R. Dixon Speas to officiate. Total attendance reached near the 750 mark.

Absorbing Bureau of Aeronautics film, "Now It Can be Told," opened the February **KANSAS CITY SECTION** meeting. Depicting the capture of an enemy submarine in reparable condition, it highlighted the planning, skill and danger involved in this technical undertaking.

M. F. Vanik, Boeing Aircraft Co., presented a paper by George S. Schairer, chief aerodynamicist at Boeing, entitled "Some Effects of Payload versus Range Characteristics on Transport Aircraft Efficiency." Section Chairman R. W. Rummel, Transcontinental & Western Air, opened an active discussion period with a suggestion for the design of a ship convertible for either application to high payload or long range, thereby achieving standardization of equipment applicable to two contrasting modes of operation. Emphasis in the ensuing discussion was placed on the close relationship of future aircraft to the type of powerplant and the numerous new factors growing out of recent developments.

Problems facing engineers designing and developing a functional and adequate truck for the future were discussed by Fred B. Lautzenhiser and H. E. Simi at meetings of **SAN DIEGO DIVISION**, Feb. 7, and **SOUTHERN CALIFORNIA SECTION**, Feb. 8. Mr. Lautzenhiser, consulting engineer, motor transport, International Harvester Co., who spoke on "Facts and Predictions about Motor Transport and Its Use," reported that functionability of transportation equipment has received more and more attention as the user has been forced to the joint consideration of income and operating costs. He feels that most near future improvements will be merely refinements of existing designs, so that future vehicles will be lighter but stronger and more durable, will have better payloads, better balance and driving handling, equalized tire loads and tire wear, improved motors and fuels providing higher power to gross weight ratio, decreased maintenance expense, and better cooling systems. Predictions for the future are automatic transmissions, power steering, vacuum braking, two-way radio, polarized headlighting, floating driver's seat, and non-explosive safety fuel tanks. Three-billion-dollar Federal Aid Highway Program, he said, promises liberalization of size and weight restrictions.

For the present, however, the American Association of State Highway Officials has agreed on a code of standards of size and weight for trucks. While by no means perfect, he feels that these standards form the first realistic approach to a necessary code, and should be supported. In essence, the code limits width to 96 in. for existing highways, length to 35 ft with extensions for larger combinations, and axle gross weight to 18,000 lb. Mr. Lautzenhiser believes a mistake has been made in basing regulations on building trucks to fit roads and bridges rather than making roads and bridges to accommodate trucks, but explained that this policy is excused on the basis that heavy-load trucks form only 1% of total vehicles operated on state roads.

Discussing "Design Features of Modern Buses," Mr. Simi, manager of the Bus Division, Kenworth Motor Truck Corp., pointed out that salient design considerations are maintenance cost, fuel economy, driver comfort, rider comfort, and first cost. Important needed improvements, he said, are 7-speed mechanical transmission with fingertip control, improved gears, better braking, reduced noise and better mufflers.

Unique feature of **MID-CONTINENT SECTION** meeting, Feb. 1, was a review of the National Meeting in Detroit by a delegation of Section members. At the evening session following, M. B. Chittick, Pure Oil Co., a former colonel in the U. S. Army Chemical Warfare Service, spoke on "One Suit and Two Shirts." Title alludes to Mr. Chittick's entire wardrobe during his Intelligence work investigating German technical developments. He praised Swiss engineering in general, and described Swiss development and use of reversible propellers to bring airships down in a "pancake" manner. Raw materials, he said, are obtained by a sound stockpile program administered by a planning council.

Better cars, developed conservatively and with more attention to fundamentals, were forecast by Charles A. Chayne, chief engineer, Buick Division, General Motors Corp., at **WESTERN MICHIGAN SECTION** meeting, Jan. 29.

L. B. Thomas, foundry manager, Wilson Foundry and Machine Co., reported at the Section's Feb. 21 meeting that foundry modernization has led to improved machine shops, good cupola control and higher strength iron. He recommended cleaner, lighter and better ventilated foundries, and suggested, in answer to a question, that engineers could best help in designing for better castings by holding to uniform sections to reduce shrinkage and chill.

DISCUSSION SOLICITED

by Fuels & Lubricants Activity Committee

The F&L Activity Committee has arranged for publication by the SAE Special Publications Department of the paper on "Motor Oils – Regular, Premium and Heavy Duty" presented by H. R. Wolf at the 1946 Annual Meeting – together with all written discussion which may be submitted on or before May 15, 1946.

Members should send written discussion directly to SAE Vice-President J. C. Geniesse, Atlantic Refining Co., 3144 Passyunk Ave., Philadelphia, Pa. Discussion should be submitted in triplicate.

Members wishing the paper itself to use as a basis for preparing written discussion may obtain copies from H. R. Wolf, General Motors Corp., General Motors Building, Detroit, Michigan, or from SAE Headquarters.

When finally published, the paper and discussion will be available to members at 25¢ and to non-members at 50¢.

SAE Men Active in Edison Centennial

Under the chairmanship of SAE Past-President C. F. Kettering, formation of the basic committee for a Thomas A. Edison Centennial is nearing completion. Feb. 11, 1947, will be the 100th anniversary of Mr. Edison's birth and, during the centennial year, the committee, under the sponsorship of Edison Pioneers – an organization of men and women closely identified with the early work of the inventor – will endeavor to coordinate interest in commemorating the contributions of the master inventor. Mr. Edison became an SAE member in 1911.

Committee Members

Other SAE members serving on the committee include Henry Ford, honorary chairman, SAE President L. Ray Buckendale, Harvey S. Firestone Jr., president, Firestone Tire and Rubber Co., Frank A. Howard, president, Standard Oil Development Co., and Alfred P. Sloan, Jr., chairman, General Motors Corp.

ERRATA

IN the discussion of the "White Hydro Torque Drive," by R. Brunken on p. 48 of the February, 1946, *SAE Journal*, the author's remarks on the use of stampings for torque converter vanes were followed by the sentence, "Such a design may sacrifice operating efficiency." This statement was never made by Mr. Brunken, who believes rather that stamped vanes can be made to give an even higher efficiency than cast vanes.

In the digest of the paper the sentence, "The main elements employed, he said, are a hydraulic torque converter in combination with a newly developed hydraulic coupling . . . " should be changed to read "The main elements employed, he said, are a newly developed combination of a hydraulic torque converter with a hydraulic coupling . . . "

New T & M Committee Studies 2-Way Radio

LAUNCHING a new engineering study to determine the best method of adapting two-way radio in the fleet transportation field, the Radio Communication Committee of the SAE Transportation & Maintenance Technical Committee uncovered two important troublesome factors which will require extensive study to achieve easy and simple installation.

Members of the new committee agreed that public utility companies, ambulances, common carrier operators, automobile towing services, and many physicians are all interested in two-way radio communication on commercial vehicles and passenger cars.

"Better utilization of vehicles and crews, reduction of mileage, and savings in cost could be achieved by many fleets of vehicles provided this committee, composed of fleet engineers and communications experts, is able to solve some of the problems." Chairman W. C. Baylis, New York Power & Light Corp., Albany, said at SAE Headquarters, 29 West 39th St., following the first meeting of the group, Feb. 6.

Location Being Explored

Initial task considered by the committee was a study of the preferable location of radio equipment in a truck, bus, or automobile. It was disclosed that the "package" may weigh as much as 160 lb. and the minimum dimensions appear to be something like 30 x 24 x 17 in. The equipment must be placed in a strong, splash-proof container, if mounted externally and the electronic devices must be shielded from interferences caused by the vehicle's ignition and lighting systems.

The second major problem as seen by the group, is to find some practical way of increasing the vehicle's capacity for generating electricity to power the equipment. It was indicated that the size of the generator will have to have several times the capacity of those most commonly used in the majority of trucks, buses and automobiles.

For example, Mr. Baylis pointed out that the standby power required will be as much as eight amp, minimum. He said that electrical energy must be generated at idling speeds of the engine, and stored in storage batteries of several times the capacity of those generally in use in these vehicles today. "Only by coordinating the thinking of engineers with experience in the design and operation of vehicles, and of experts in the radio communications field, can we solve some of the basic problems with which we are faced," he continued.

The location of the antenna will require considerable study also. For simplicity, antennas have been attached to bumpers, but it was reported at the meeting that this is generally unsatisfactory. At or near the center of the vehicle's roof appears now to be the best location, it was disclosed.

Determination of radio wave channels to be allocated to fleet operators and to physicians and others wanting two-way radio communication will be determined by the Federal Communications Commission. Engineers do not yet know how many frequency bands will be allotted, and it was suggested that several operators would have to use the same band.

This sharing would cause complications similar to the telephone party lines, but may be necessary in view of the apparent large demand for radiotelephone equipment.

Some members of the committee also pointed out that some regulatory provisions would probably be imposed by the FCC in respect to licensing operators and assuring proper maintenance of radio equipment on vehicles.

It was agreed that the best experience in two-way radio communication to date is had by municipal and state police departments. The group will study this experience to obtain as much background information as possible.

Serving with Chairman Baylis on the SAE committee are J. H. Bolles, Delco-Remy Division, General Motors Corp.; G. Gerlach, Radio Corp. of America; G. M. Smith, American Telephone & Telegraph Co.; C. F. Meyer, General Electric Co., Don K. Wilson, New York Power & Light Corp., and H. W. Fitch, Auto-Lite Battery Corp. Other members of the committee are: D. S. Bond, Radio Corp. of America; Linn Edsall, Philadelphia Electric Co.; D. F. Geisey, Studebaker Corp.; C. C. Hudson, Tennessee Valley Authority; Lloyd Morris, Galvin Mfg. Corp.; S. G. Page, Equitable Auto Co.

Two-Radio Group Meets

Seated left to right are Chairman W. C. Baylis, New York Power & Light Corp., J. H. Bolles, Delco-Remy Division, General Motors Corp.; G. Gerlach, Radio Corp. of America; G. M. Smith, American Telephone & Telegraph Co.; C. F. Myer, General Electric Co.; D. K. Wilson, New York Power & Light Corp.; R. W. Fitch, Auto-Lite Battery Corp., and Mary Krug, SAE Staff.

1946 CRC Handbook Double The Size of Predecessor

THE 1946 Handbook, just published by the Coordinating Research Council, Inc., contains an entirely new section, Lubricants Research. Therefore, it has been given the title CRC Handbook, instead of CFR Handbook, as were previous editions dealing only with fuel research. The new Handbook is about twice the size of its 1944 predecessor, and includes more than twice the number of authorized CRC test procedures, 44 as compared with 18. The 81 figures include charts, test procedure data forms, and illustrations of test apparatus. Like its predecessors, this issue of the Handbook is limited and its distribution partially restricted. The price of the 1946 CRC Handbook is $7.00, and orders for it may be sent to the Coordinating Research Council, Inc., at 30 Rockefeller Plaza, New York 20, N. Y.

Procedures Are Shown

In the Handbook are presented the latest revised editions of CRC test procedures, and information bearing on the development, use, and subject matter of these procedures. Included in the Fuel Research section are Part One, Motor Fuels; Part Two, Aviation Fuels; and Part Three, Diesel Fuels; in the Lubricants Research section, Part Four, Engine Oils; and Part Five, General Lubricants. Appendix I deals with CRC material, and Appendix II presents bibliographies.

The 1946 CRC Handbook is the third of a series, the first of which was published in 1941 by the Cooperative Fuel Research Committee. In 1942, the automotive-petroleum research initiated in 1922 in the creation of the CFR Committee was expanded in the organization of the Coordinating Research Council, Inc., by the American Petroleum Institute and the Society of Automotive Engineers. The Cooperative Fuel Research Committee, as the Coordinating Fuel Research Committee, became one of the Council's three technical committees, and issued the second CFR Handbook in 1944. The Coordinating Lubricants Research Committee, whose work is represented in the new section of the 1946 CRC Handbook took over, on its formation, the programs of five SAE committees. The Coordinating Equipment Research Committee, the third of the technical committees, represents the equipment design and operating viewpoint in the fuels and lubricants research. A War Advisory Committee acts as a liaison body between the armed services and the Council, and an Assignment Committee performs similar functions for industry.

Aircraft Cargo Loading Problems Challenge Engineering Ingenuity

Digest of paper

by M. B. CRAWFORD
United Air Lines, Inc.

■ Chicago, Dec. 4

(Paper entitled "The Air Lines Air Cargo Problem")

NOW that radio, radar, and well-located weather reporting stations have made it possible for the airplane to fly over any part of the world in almost any weather, Mr. Crawford declared, it is time for terminal facilities and ground equipment to advance to match the speed of aircraft improvement. On the positive side of the picture, he said, operational ideas are coming fast to meet the postwar challenge, and progress in the last year has been considerable. While the percentage of total cargo carried by the airlines is still quite small, he foresees a great future which is in the hands of the designers and producers of today. It is not a local problem but one which concerns producer, carrier and consumer. Thus the chain of procedure which is developed for this operation must take the whole air transport picture into consideration.

Since speed is the paramount issue in aircraft cargo and passenger transportation, and loading and unloading make one of the principal bottlenecks, he pointed out, initial consideration should go to improvements in this sector of operations.

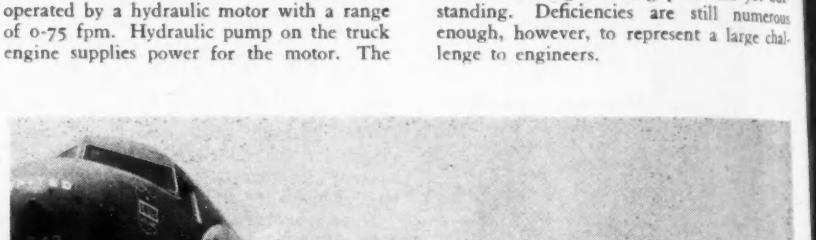
Already established solution for the problem of door heights – 4 ft from the ground in the DC-3 – is the body lift truck for pickup and loading. Normal height is 4 ft, and this can be extended to 14 ft. It is possible to add a hydraulic tailgate which can be loaded on the ground, hoisted to the truck level and used as an ordinary tailgate or as a loading platform. A fork lift may be used to load things too heavy to lift.

DC-3 front pit bottleneck brings up the question of relative advantages of chutes and other loading methods. A circular chute, he said, will facilitate simultaneous loading and unloading, but retains the inherent chute disadvantages of required moving by hand, crowding at the pit, and limitation to small packages. Preferable is the use of tubs which can be preloaded and hoisted by the fork lift.

Answer to most problems, he reported, is a new combination truck and belt loader. Truck body is a standard walk-in cab engine type, with 3-ton capacity. Its working platform on the roof is high enough to accommodate DC-3 and DC-6 doors. Belt loader is located inside the truck, and is operated by a hydraulic motor with a range of 0-75 fpm. Hydraulic pump on the truck engine supplies power for the motor. The belt can be extended through the door to any desired height. The truck body provides room for off and on cargo, protection for cargo and comfort for the cargo handler. This apparatus eliminates all objections to the simple belt loader. There is ample space outside the cabin door for sorting and transferring mail.

During wartime, he said, conversion of DC-3's to all-cargo planes was accomplished with surprising success. Front pits and radio compartments remained as they were; seats and linings were removed, and bin separators added to divide loads. Cargo tie-down arrangements of varied complexity prevented shifting in flight. Aggravating problems of small doors and poor door heights were encountered, but some apparent disadvantages such as sloping cabin floors were turned into advantages by clever utilization of material at hand.

A great deal of constructive thinking has already been applied, he reported, to the solution of cargo loading problems yet outstanding. Deficiencies are still numerous enough, however, to represent a large challenge to engineers.



Above: Cargo loading operations on a DC-3 cargo ship

Left: Cargo tie-down arrangements on a DC-3

Minimum Standards Set For Transocean Flights

Excerpts from paper

by FRANK R. CANNEY
Boeing Aircraft Co.

■ Chicago, Dec. 3

(Paper entitled "Provisions for Overwater Operation")

ACCELERATED by the requirements of World War II, regularity of transocean aircraft operation has increased to such a point that nonstop flights spanning even the Pacific Ocean have lost their novel aspect. Single engine land planes were regularly and successfully ferried across both the North and South Atlantic when time was the prime military requisite.

Consideration of regularly scheduled transocean passenger operations indicates that at least the following may be established as the minimum provisions required:

1. Equipment and installations to give every possible assurance that all scheduled flights will depart regularly at the scheduled time and arrive at the advertised destination within minutes of the time planned.

2. Equipment, configuration and strength of structure to assure that emergency landings on water can be effected in a manner permitting all occupants in their assigned stations to survive the ditching and be supported above the water level with the highest degree of safety and comfort commensurate with the circumstances, pending rescue.

The ideal aircraft for long range overwater operation should be provided with a minimum of four conventional main power units or an equivalent division of unconventional units, to assure its ability to complete virtually all scheduled flights, even with an abnormally high rate of mechanical failures. Range of operating altitudes should be large, to permit flight at the altitude affording the greatest wind and weather advantages of the moment. Range of operating speeds should be high enough so that strong winds do not require unnecessarily large increases in the amount of fuel needed to overcome them. Aircraft with sufficiently high cruising speeds and altitudes may select operating levels between 15,000 and 35,000 ft to capitalize on the assistance afforded by winds during periods when they are unusually strong.

Propellers are required to be of the full-feathering type. Reversible pitch types will probably provide sufficient improvement in landing performance to make their use necessary in consideration of the economic gain they afford. The slinger ring appears to be the best present solution to prevention of ice accumulation on propeller blades, but development of a means of applying exhaust or other heat to the blades is likely to be an early future improvement.

Anti-icing Provisions

Conventional engines must be provided with means to prevent accumulation of either impact, throttle or fuel ice in their induction systems. Ample supplies of heated air from a sheltered inlet will prevent impact ice from entering the induction system and prevent or remove throttle ice. Throttle ice formation is confined to the extremely narrow range of temperatures between approximately 30 F and 40 F, and with introduction of fuel into the diffuser, temperature required to remove ice cause by fuel vaporization is 70 F. An air temperature of 50 F will prevent fuel icing with the proper type of carburetion.

Accessory power supply is required to provide thermal anti-icing for aerodynamic surfaces, pressure and air conditioning in cabins, and necessary electrical supply for cabin and radio facilities. To condition the cabin air, each accessory power unit must maintain a flow of 40 lb of air per min at any altitude between sea level and 30,000 ft with a maximum pressure differential up to 6.55 psi . . . thermal anti-icing of aerodynamic surfaces requires approximately 1500 Btu per hr for each sq ft of surface protected, and with heated air used as the anti-icing medium, each accessory power unit must also supply a flow of air heated to 300 F at the rate of 130 lb per min . . . and maximum non-peak electrical requirements are estimated to be approximately 800 amp direct current, and 2500 volt amperes of 400 cycles per sec alternating current at 100 volts, with each accessory power unit designed to provide 150% of these requirements under momentary overload conditions.

Converting the power requirements to a common denominator, it appears that each of the duplicate units must have an output of 118 hp, which remains nearly constant from sea level to 30,000 ft. Approximately 1/6 of the total heat provided, that required for cabin heat, is derived through compression of the cabin air supply, the remainder from exhaust gases of the accessory powerplants.

Ditching Provisions

In addition to the foregoing provisions needed to assure flight regularity, completely different provisions are required to assure every reasonable probability that all occupants of the aircraft can survive an emergency landing on water and be safely supported above the water with a certain degree of comfort until rescued.

Considering the increase in cruising speeds, improved engine performance and the transocean operators' policy of immediately adopting an alternate flight plan at the first indication of trouble, it appears that the chances against ditching on the North Atlantic route are many thousands to one.

A low wing airplane with landing gear retracted and no protuberances, scoops, openings or areas of weakness on the surfaces which will be directly in the path of the relative water stream during the deceleration period of ditching, appears most likely to have satisfactory ditching qualities.

Fairly complete reports on 37 ditchings of the B-29 show that the extent of damage to the ditched aircraft did not necessarily vary directly in proportion to the wind, weather and sea conditions, but was largely affected by the ditching technique used. Good technique would give consideration to the angle of attack, flap position, combined rate of descent and forward speed, direction to the wind and sea, and the air craft gyrations which might result from the prevailing wind and sea conditions. Successful ditchings with no casualties and no major break in the structure upon contact with the sea have been reported under 15 knot wind and 8-ft-high sea conditions.

Passing the "Know-How"

By L. RAY BUCKENDALE
President, Society of Automotive Engineers

The scientific "know-how" of the ages has been handed down to present day engineers, but this brings up the question as to how this "know-how" is being passed along. One way is by formal education from the writings of the past, and another is by working under and with older and more experienced men.

With the increasing tempo of modern times, this passing along of knowledge has become more important, because there has not been time to reduce our technical "know-how" to writing, and I think we have been remiss in training the younger men. We have failed to sell the engineering profession. We have failed to make the world recognize the importance of the engineer and the technician. We have even permitted an engineering draftsman to be thought of as one who draws lines on paper, when we know that he must carry the "know-how" for the making of the part, and that the drawing merely represents "written instructions." There is as much difference between the ability to copy a drawing and a designer as there is between the ability to write and a great author, or the ability to paint and a great artist. The above holds for all technologies.

We older engineers must spread the gospel that engineering is a great profession in order to get the interest of the youngsters. We in the SAE can do a great deal for them. First, we can take an interest in and cooperate with the schools and universities, so that the years spent in them bring the graduates into closer mesh with technical industry. We should foster student activities of the Society at the universities and in the Sections. Second, we can offer papers in our Section activities which are of interest to the younger technicians. Third, we can introduce more of the younger men into our technical committee activities. Our technical committees are working on many hundreds of problems in steels, fuels, plastics, electronics, etc., and we are trying to coordinate all of these activities under the new Technical Board.

My experience with the SAE has been that the more you give in the cooperative activities of the Society, the more you gain, which philosophy applies also to life. I have been active in the Society since 1919 and have put a lot of time and energy into my Society activities. But this time and effort, I feel, was a small price to pay for the friendships and experience I have gained.

(Excerpts from talk before Cleveland Section, Feb. 11).

Better Starting Boosts Diesel's Postwar Chance

Digest of paper

by E. J. McLAUGHLIN

California Research Corp.

■ No. California, Dec. 14

(Paper entitled "Fuel Requirements of Present-Day High-Speed Diesel Engines")

MULTIPLE advantages of low fuel consumption, utilization of cheaper fuels, compactness of power unit, efficiency under intermittent load conditions, and complete combustion with high thermal efficiency, have made the high-speed diesel an important piece of military equipment, and guarantee it a prominent place in postwar transportation.

Development of high-speed diesels has been made possible, Mr. McLaughlin said, largely by the introduction of improved fuels which permit acceleration of the combustion process to make high-speed, smaller bore engines practicable.

Since the diesel engine, unlike the gasoline engine, compresses air in the cylinder and then adds diesel fuel, there is a tendency for combustion products from the burning of the air immediately around the fuel spray to insulate the remaining unburned fuel from the air. Thus, he said, the biggest single problem confronting diesel engine manufacturers and fuel suppliers is the development of means by which all the air may be combined with all the fuel in the shortest time possible. Otherwise some of the fuel will be burned after exhaust, accomplishing no purpose.

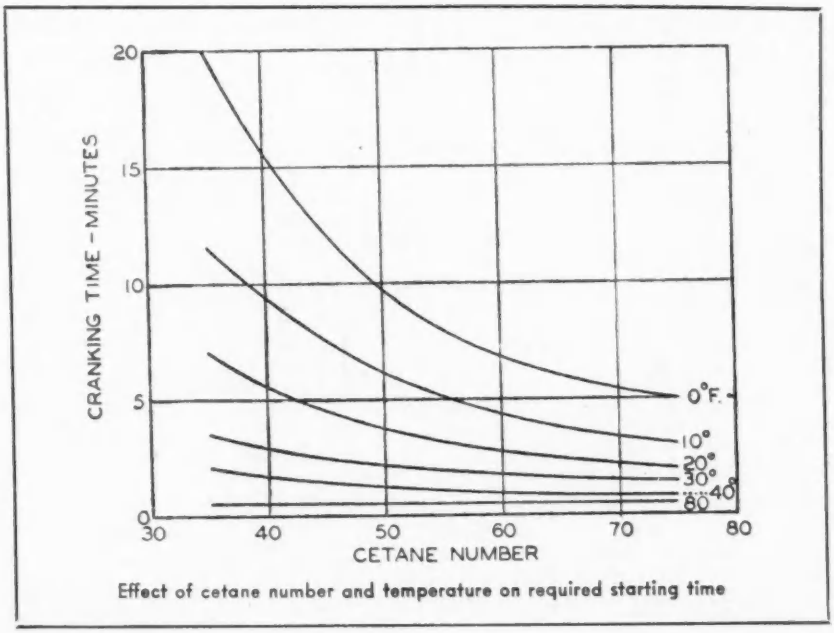
Diesel fuel, he pointed out, must have a pour point low enough to keep it liquid at all atmospheric temperatures in which it is to be used. For starting, cetane number is the vital characteristic. This is an index of the relative times required for fuels to start burning after leaving the nozzle. Period between injection and ignition is called the ignition period. Ignition delay qualities of any fuel are expressed in terms of a reference fuel blend with the same delay period; n-cetane reference fuel has a short delay period, and α-methylnaphthalene a long ignition delay period. A 40-60 blend is assigned a cetane number of 40. Obvious advantage of high cetane number fuels, he explained, is that they will begin to burn while the piston is near the top, where temperatures and pressures are highest.

Above 40 F, he said, all fuels tested in one laboratory test started readily. However, the chart shows that when atmospheric temperature was lowered to O F, five min were required to start 75 cetane fuel, and 20 min for 35 cetane.

Laboratory investigations based on the need for supplementary means of accomplishing low-temperature starting have developed special starting fluids which Mr. McLaughlin described as volatile compounds with wide explosive limits, subject to spontaneous combustion at low temperatures and pressures. With one of the materials perfected, he reported, it was possible to obtain starting in 20 or 30 sec where several hours previously had been required.

Important fuel properties affecting output and economy are heating value, volatility and viscosity. Net volumetric heating value of the fuel (Btu/gal) determines the engine's power output at a given rate of fuel consumption. If the fuel is not sufficiently volatile, burning will be slow and productive of black smoke in the exhaust and mechanical maintenance difficulties. Low viscosity fuels sometimes undergo leakage past the plungers of the fuel pump to the extent that engine power is substantially reduced.

In an engine in good mechanical condition under normal operation, fuel with the correct volatility and a high enough cetane number will permit clean combustion. There is a minimum cetane number, he explained, that is required for this purpose with a given engine and operating condition. Fuels below this number will burn too late and discharge both burned and unburned fuel through the exhaust system; on the other hand, higher cetane fuels will give no better operation than the minimum value fuel.



Effect of cetane number and temperature on required starting time

While peacetime applications of diesels were explored somewhat during and before the war in the truck and railroad fields, Mr. McLaughlin believes that the combined impetus of success in military usages and expansion of production facilities will greatly accelerate their increased use.

Design Engineers Cater To Passenger Psychology

Digest of paper

by HOWARD K. EDWARDS

United Air Lines, Inc.

■ Chicago, Dec. 4

(Paper entitled "Psychological Requirements for Aircraft Passenger Design")

SPECIALIST can cooperate with aircraft engineer, Dr. Edwards pointed out, to produce various design effects which will add to the luxury character of air travel. From colors and contours to measures of safety and comfort, he said, aircraft interiors are due for radical improvements.

Colors, he said, must be used scientifically, with attention to the strong impressions they will make on passengers. He discussed in detail the stimulating effects of red, coolness of blue, changeability of purple under light, and almost ideal effects created by green. Color is chosen after careful determination of the desired atmosphere. Exciting interiors to arouse enthusiasm in passengers may be best for short flights, he said, but transcontinental or transoceanic flights call for relaxing surroundings.

Contours, too, are important: utilization of various curves and lines can give the illusion of wideness and roominess, and of strength in spite of lightness. Most important, he said, is the avoidance of openings or projecting parts which might injure passengers.

For overall design perfection, the efforts of heating, ventilating and sound engineers must be enlisted. Cabin temperature, he believes, should range between 69 and 70 F, and humidity between 30 and 60%. Care must be taken to see that heat is equally diffused throughout the cabin, not concentrated in particular spots. Decibel level should be brought down to 35 in the passenger compartment, he believes, and 55 in the flight compartment.

Oxygen supply for a 50-60 passenger plane with a crew of five, he said, should carry not over 250 lbs. of oxygen and equipment. This will furnish oxygen to every seat, with a mask for each passenger and crew member, and also six portables with at least three charge outlets into the main system. Protection for ½-1 hr will give ample time to get the plane down to a safe altitude in emergencies.

The airlines' approach to the safety problem has been mistaken, in Dr. Edwards' opinion; safety measures should be placed in plain sight. The reassurance they will offer passengers is, he believes, greatly preferable to the false security offered by hiding oxygen masks and fire extinguishers, thereby implying that they will not be necessary.

Steering Control Profits By Independent Suspension

Excerpts from paper

by C. F. HAMMOND
Gemmer Mfg. Co.

■ Annual Meeting, Jan. 9

(Paper entitled "Effects of Suspension on Steering")

THE tire travelling along the road is operated on by several forces. Fig. 1 shows a tire directed along path OA. Area D represents the contact between tire and road, and is a function of load, tire size and inflation pressure. A side force applied at C will cause the tire to travel along the path OB. The angle (a) formed between OA and OB is called the *slip angle*. A resisting force F is set up in the tire to resist the side force. This is called *cornering force*. As the side force is increased the slip angle increases, but not in direct proportion. The ratio of cornering force to slip angle is called *cornering power*.

Camber, shown in Fig. 2, causes the tire to develop *camber thrust* in the direction in which it is inclined. Positive camber reduces, and negative camber increases, cornering power.

When a tire is operated at a slip angle there are forces set up which tend to reduce the slip angle. This force attempts to rotate the wheel about the king pin and is called *self-aligning torque*.

The wheel suspension is responsible for the attitude of the tire with respect to the road. The double transverse lever type has the links so arranged that the tread is maintained constant, and camber changes during vertical wheel movement. With links of equal length, camber will be constant but tread change takes place. In any design of this class camber changes with body roll. Wheelbase remains constant. The trailing arm type theoretically maintains constant camber, but the arms are so disposed that centrifugal force imposes unfavorable loads, thus causing a camber change; tread remains constant, wheelbase changes. The fixed king pin or guided type maintains constant camber, wheelbase and tread.

In all these types of independent suspension, brake application or any other force does not introduce a change of caster angle.

The relation of front to rear suspension is of cardinal importance to car stability and control, and will determine whether the car will oversteer or understeer. Oversteering causes the car to steer itself into the direction of a lateral force working on it, such as a side wind, thus requiring a reversal of the steering wheel movement. In the extreme condition the rear end of the car will try to pass the front end.

Understeering causes a car which has been directed into a turn or operated on by a lateral force to travel at a greater radius, and thus requires greater movement of the steering wheel to maintain the desired radius of turn. This contributes to the stability of the car in straight ahead driving on cambered roads or under other influencing forces. In order to produce this desirable effect, the slip angle of the front tires must be greater than the slip angle of the rear tires. It is desirable to have a slightly greater load on the front wheels.

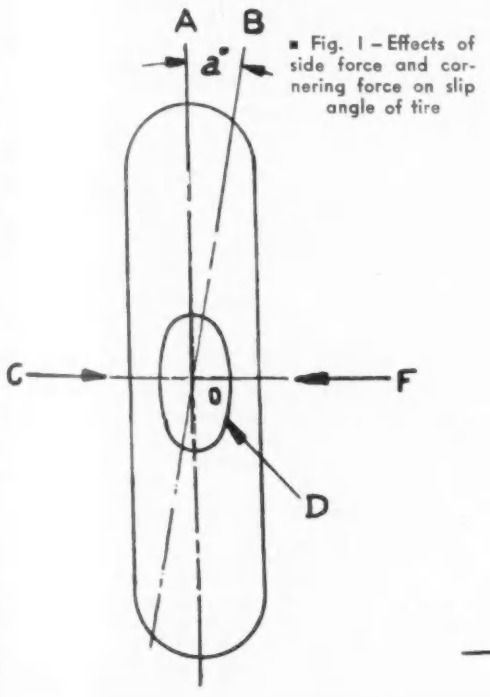
Ride comfort requires that we have fairly equal spring rate distribution. The rear suspension, because of the rigid axle and usual attachment of springs, has a higher roll center than the front. In order to have nearly equal roll stiffness to effect uniform load transfer, a sway bar is required. The rear suspension, besides permitting the wheels vertical freedom for ride comfort, must be constrained from moving in a manner to cause any angular or lateral displacement of the axle.

While the front wheel suspension has the primary requirements of supporting the wheel and tire assembly and constraining it to certain movements, it is highly desirable that it move in such manner that the steering linkage may be properly attached to it.

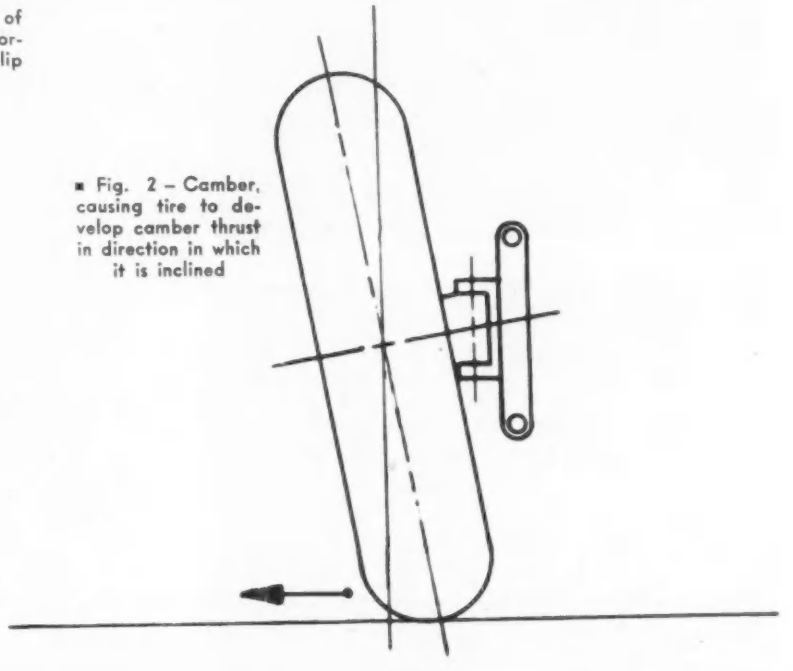
We have not only to coerce our wheels into a satisfactory vertical movement during jounce and rebound, but also to maintain a proper relationship during pitch and roll movements. In addition to this it is well to investigate the same disturbances while the wheels are displaced from the straight ahead. It is very easy to have errors creep in, which show up in wheel fight on a turn, in a car that was quite acceptable on the straight away.

Overall steering ratio is affected by suspension in one important respect. Overall ratio is made up of steering gear reduction and linkage. Gear ratio may be made almost anything desired, but it may be well to have most of the reduction in the gear. Linkage may and usually does have a ratio greater than unity because of the different arm lengths and the manner in which they are disposed. Probably the biggest factor in deciding on steering ratio is the maximum effort to be expended, which occurs in parking. A ratio of 28 to 1 might be required. Of course, a large part of normal driving is straight ahead. If we have built a car with good stability and kept the sponge and any unnecessary looseness or lost motion out of it, the steering wheel scarcely needs to be moved to accomplish this, even with very high ratios.

The change made by so many manufacturers to independent suspension was directed not only by the desire for improved riding qualities but to obtain better steering control. There are conflicts between them and as we progress there must be a fair compromise — no slighting of one at the expense of another.



■ Fig. 1 – Effects of side force and cornering force on slip angle of tire



■ Fig. 2 – Camber, causing tire to develop camber thrust in direction in which it is inclined

Mathematics Eases Tolerances Safely

Excerpts from paper

by Lt.-Com. WILLIAM S. EVERETT, USNR

Office of Inspector of Naval Material

■ No. California, Nov. 12

(Paper entitled "The Theory of Probabilities Applied to the Manufacture of Diesel Engines")

THE theory of probabilities has played an important role during wartime. In warfare it has provided criteria for the number of shells to be put into an area to obliterate it, the type of pattern to use in shelling an objective, the optimum bomb load to be carried out, and the number of bombs required for the target. In war industries it has controlled the quality of war goods and economized on inspection, by sampling inspection and quality control procedures.

To study the theory of probabilities, an engineer is required to think along lines that engineering training has taught him specifically not to think. An engineer has to know facts and data in order to design and manufacture. He takes handbook data as exact and accurate. When performing test work he attempts to eliminate all the variables except one and then collects data on that one variable. This procedure often is impracticable, and the probabilities are that he has not eliminated the variables.

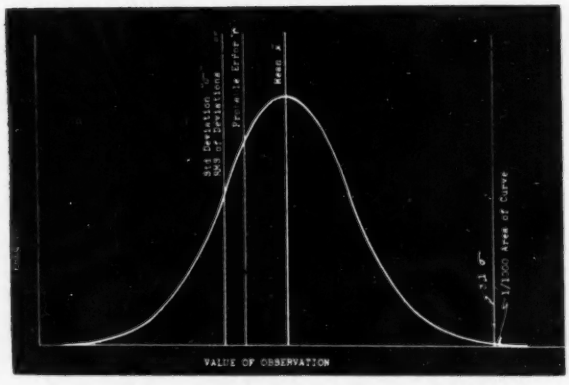
Most engineers will not question the accuracy of measurements of, for instance, firing pressures or cylinder-liner dimensions. An inspector, however, has learned by sad experience to qualify all measurements. Every number or figure has a fringe on it. It is not to be regarded as exact but as so much plus or minus a bit, and the size of this bit is one of its really important qualities.

As an example, Fig. 1 illustrates 70 measurements of a 16-in. diesel-engine cylinder liner taken by 12 different machinists, on different days, with four or more calibrated micrometers. Measurements were taken in the same place in the cylinder liner and therefore do not denote "out of roundness" or taper but rather the precision of the measurement. It includes variations in micrometers, temperature of micrometer, difference in "drag" as used by the machinist, and possibly errors in reading.

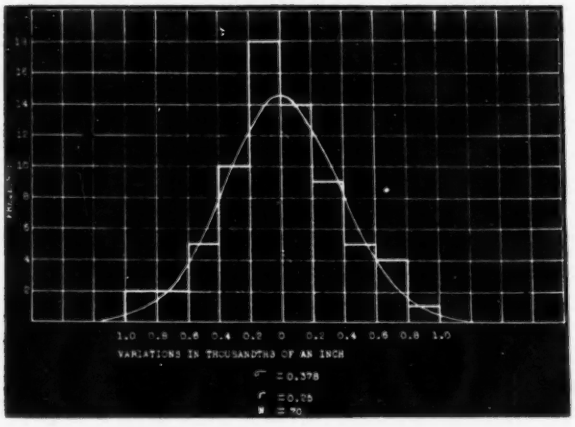
Fig. 2 is an illustration of the normal curve of error which is the basis of this theory. It is symmetrical about the mean $\bar{X}$ where the frequency of observations is the largest. The standard deviation σ is the root mean square of the observations. Its analogy in engineering terms is the radius of gyration about the axis of symmetry of the area under the curve. If the area under the curve is taken as unity, any portion represents the fraction of the total the particular observation in question will occur. The fraction then is the probability of occurrence. The probable error is such that the probabilities for making a larger observation are exactly equal to the probabilities of making a smaller observation.

Table 1

Description	Tolerance	Number of Observations	Maximum Range	$\bar{X}$	σ	Probability of Accepting Parts
Piston diameter (at wrist pin)	11.967 in. / 11.968 in.	525	11.964 in. / 11.970 in.	11.9665 in.	0.82	0.337
Cylinder liner diameter	12.000 in. / 12.001 in.	1150	11.997 in. / 12.004 in.	12.0006 in.	0.84	0.806
Crank pin diameter	8.000 in. / 8.001 in.	599	7.997 in. / 8.002 in.	7.9995 in.	0.82	0.390
Crank main journal diameter	8.500 in. / 8.501 in.	500	8.497 in. / 8.502 in.	8.5000 in.	0.75	0.880
Crank main journal diameter	9.248 in. / 9.250 in.	899	9.245 in. / 9.253 in.	9.2498 in.	1.07	0.682
Crank pin diameter	8.998 in. / 9.000 in.	843	8.996 in. / 9.003 in.	9.0000 in.	0.73	0.807



■ Fig. 1—Histogram representing measurements with inside micrometer of 16-in. cyl liner.



■ Fig. 2—Normal curve of error.

The normal curve is used to idealize the recalcitrant observational data and smooth out the irregularities due to sampling fluctuations. It also provides an efficient device for classifying data and predicting the future.

With the normal curve fitted to the data in Fig. 1, the standard deviation is 0.000375 in. The probable error is 0.00025 in. Now we have a number with a fringe on it. The cylinder liner diameter is 15.999 ± 0.00025 in. We know now what are our chances that the dimension given us is correct.

Fig. 1 relates to the precision of measurement. The precision of machine work has as its engineering expression "machining tolerance," or the maximum allowable "plus or minus a bit" described earlier.

The problem of tolerances has been bothersome to the inspector, because strict adherence to the tolerances on engineering drawings would harmfully curtail production; disregard of tolerances entirely would not insure interchangeability of engine parts. Therefore, the inspector must be sure that engine parts are good enough for the purpose intended, not necessarily that the drawing tolerances have been observed.

Table 1 is a tabulation of important properties of a group of histograms of dimensions of important parts of diesel engines presented the Navy. It illustrates how small are the probabilities of accepting a part if the engineering tolerances are observed. The tolerances are unrealistic, and diesel-engine manufacturers are not alone in

turn to p. 33

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	Burkhalter, R. R.	German Automotive Transmission Systems Development & Design	March 4, 46
	Corey, Lt.-Col. C. H.	Technical Investigations of German Automotive Materiel	March 4, 46
	DeHaven, J. C.	The Development of Magnesium Alloys as Aircraft Materials	April 3-5, 46
	Franzen, Tore	Suspension & Track of German Military Track Laying Vehicles	March 4, 46
	Glen, Earl W.	Observations of the German Rubber Industry	March 4, 46
	Grunder, Maj. L. J.	War Developments of the Oil Industry in Austria and Roumania	March 4, 46
	Hall, R. S.	Aircraft Gas Turbines with Centrifugal Compressors	April 3-5, 46
	Hammen, T. F., Jr. Rowley, W. H.	Factors Pertaining to the Installation of Inverted, In-Line Air-Cooled Engines	Nov. 1, 45
	Heldt, P. M.	Transmissions Giving Uninterrupted Acceleration	Feb. 13, 46
	Heron, S. D.	Fuel Sensitivity & Engine Severity in Aircraft Engines	April 3-5, 46
	Holaday, W. M.	Wartime Refinery Operations and Their Effect upon Future Motor and Aviation Fuels	Feb. 1, 46
	Judd, F. V. H.	A Systematic Approach to the Aerodynamic Design of Radial Engine Installations	April 3-5, 46
	Kirchner, O. E.	A Report on the German Commercial Airline the Deutsche Luft-Hansa	Jan. 7-11, 46
	Klein, Maj. N. L.	German Military Fuels & Lubricants	March 4, 46
	McEwen, Lt.-Col. E.	Highlights of German Tank Transmission Design & Development	March 4, 46
	Monroe, K. C.	Research & Development of Aircraft Accumulators	Nov. 1, 45
	Palsulich, J. Blair, R. W.	Testing of Highly Loaded Sleeve Bearings	April 3-5, 46
	Ray, James G.	Some Requirements of a "Feeder" Airplane	April 3-5, 46
	Schairer, G. S.	Some Effects of Payload vs. Range Characteristics on Transport Aircraft Efficiency	Feb. 12, 46
	Stewart, Hugh B.	An Electrical Model for the Investigation of Crankshaft Torsional Vibrations in an in-line Engine	Nov. 1, 45
	Thorne, M. A.	German Army Vehicle Engines	March 4, 46
	Weider, R. L.	Observations of Various German Suspensions and Steering Gears	March 4, 46
	Wheeler, J. W.	German Autobahn – Its Relation to German Industrial Economy & Traffic System Used	March 4, 46
	Young, F. M.	German Radiators & Oil Cooler Structures and Facilities for Manufacture	March 4, 46

Papers Previously Announced

Vehicles

	Aldag, R., Jr.	*Diesel Electric Locomotive Operation	Oct. 9, 45
	Ayres, Vincent	Valves and Valve Testing	Dec. 6, 45
	Austen, Robert N.	Maintenance Engineering of Chassis Leaf Springs	May 9, 45
	Bentz, E. J. H.	Diesel Cold Starting Problems	June 11, 45
	Blake, R. A.	*Field Performance – Synthetic Truck Tires	May 9, 45
	Brunken, Renke	White Hydro Torque Drive	Jan. 7-11, 46
	Bryan, H. F.	Combustion in a Pre-Combustion Type Diesel Engine	Jan. 7-11, 46
	Case, Robert	Motor Trucks of the Future	Jan. 7-11, 46
	Churchill, H. E. Delp, M. Z. Hykes, P. G.	Fundamentals of Suspensions	Jan. 7-11, 46
	Collins, Tom J.	Post-War Diesel Engines	Feb. 12, 45
	Colwell, A. T.	Alcohol-Water Injection	Jan. 8-12, 45
	Colwell, A. T.	Fuel Requirements for Farm Tractors	Sept. 13, 44
	Davies, R. H.	Design of German Hydraulic Systems and their Components	Jan. 7-11, 46
	Delmel, A. H.	Performance of Hydraulic Transmissions	Jan. 7-11, 46
	Fairbank, H. S.	Highways of the Future	Jan. 7-11, 46
	Gerler, Capt. W. C.	The German Jumo 004 Engine	Jan. 7-11, 46
	Hammond, C. F.	Steering as Affected by Suspension	Jan. 7-11, 46
	Harms, Carl F.	Turbosupercharger Design and Application	Nov. 19, 45
	Hartzell, H. L.	Effect of Post-War Automotive Practices on Ignition Performance	Dec. 4, 44
	Hawthorne, W. R.	Some Factors Affecting the Design of Jet Turbines	Jan. 7-11, 46
	Heusner, C. E. Johnson, E. T.	Substitutes for Tin in Automotive Vehicles	Jan. 7-11, 46
	Holtzkemper, Lt.-Col. E. H.	*Observations on Military Transport Vehicle Operation in Europe	June 4, 45
	James, W. S.	The Perfect Automatic Transmission	Jan. 7-11, 46
	Johnson, Steve, Jr.	*Brakes	Sept. 6, 45
	Landen, E. W.	Combustion Studies of the Diesel Engine	Jan. 7-11, 46
	Laurie, G. W. Taussig, W. A. Willett, H. L., Jr. Wilson, D. K.	Symposium – Approaches to Vehicle Retirement	Jan. 7-11, 46
	Loweke, E. F.	Power Brake Valves	Nov. 1, 45
	McCain, G. L.	Engineering of Involute Splines	Jan. 7-11, 46
	McLaughlin, R. W. Harms, C. F.	*Putting Exhaust Gas to Work	May 15, 45
	Miller, C. D.	*Slow Motion Study of Injection & Combustion of Fuel in a Diesel Engine	May 17, 46
	Miller, R. J.	Torque Converters	Jan. 7-11, 46
	Mock, F. C.	Engineering Development of the Jet Engine and Gas Turbine Burner	Jan. 7-11, 46
	Moskovics, F. E.	*Cars & Men of Old & Their Challenge to You	Nov. 13, 45
	O'Conner, B. E.	Damping in Suspensions	Jan. 7-11, 46
	Oetzel, J. G.	Post War Brakes	May 10, 45
	Park, Bryan	Over the Road Diesel Operation	May 15, 45
	Price, N. C.	Mechanical Design Considerations Influencing Blading Performance in Aircraft Gas Turbine Power Plants	Jan. 7-11, 46
	Quartullo, O. F.	The Driver's Comfort	Jan. 7-11, 46
	Richardson, E. B.	*Postwar Maintenance of Buses	Sept. 15, 45
	Sanders, Ray	Cleaning Symposium – How Chemistry Simplifies Automotive Cleaning Methods and Procedures	Jan. 7-11, 46
	Schildhauer, Capt. C. H.	*Training of Personnel for the Operation of the Mars Aircraft	June 7, 45
	Schilling, Robert	Flexible or Spring Medium of Suspensions	Jan. 7-11, 46
	Schippel, H. F. Keller, R. J.	*Development of Expander Tube Brakes for Aircraft Use	May 10, 45
	Shoemaker, F. G. Gadebusch, H. M.	Effect of Fuel Properties on Diesel Engine Performance	Jan. 7-11, 46
	Shoemaker, F. G. Gadebusch, H. M.	*The Effect of Diesel Fuel Economy on High Speed Transportation	May 15, 45
	Sinclair, J. W.	*How to Drive a Truck	Oct. 26, 45
	Slemmons, C. O.	Rubber Tracks for Agriculture	Sept. 13, 45
	Smith, C. E.	*Crankcase Ventilation	Oct. 12, 45
	Smith, L. H.	Motor Coaches of the Future	Jan. 7-11, 46
	Stout, W. B.	What Motor Cars Could Be	Jan. 7-11, 46
	Super, R. K.	Review of Brake Design and Methods of Rating Brakes for Commercial Automotive Vehicles	Jan. 7-11, 46
	Taylor, C. Fayette	Effect of Engine Exhaust Pressure on the Performance of Compressor Turbine Units	Oct. 4, 45
	Twyman, L. R.	Hydraulics as Applied to Tractors and Farm Machinery	Sept. 13, 45
	Warner, Lt.-Col. N. K. Fisher, H. B. Watson, R. A.	*Mobile Training Units	June 7, 45
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Aeronautics

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	Benedict, M. C.	*Aviation Gas Turbine Installation Problems	Oct. 4, 45
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	Best, S. G.	*Propeller Balance Problems	April 5, 45
	Bowman, Otto R.	*Flight Equipment Requirements for Feeder Airline	Oct. 10, 45
	Brandt, C. S. Wold, W. C.	*Some Aspects of Under-Wing or Pressure Refueling	Oct. 4, 45
	Canney, F. R.	Provisions for Overwater Operation	Dec. 3-5, 45
	Chase, Capt. J. H.	*Control Decks for Long Range Aircraft	Dec. 3-5, 45
	Christenson, C. M.	A Report on the Nature of Ice Formation on Aircraft as Related to Airline Operations	Nov. 1, 45
	Clyman, H. J.	*Jet Propulsion & Gas Turbines in Aviation	Dec. 12, 45
	Crawford, M. B.	*The Air Lines Air Cargo Problems	Dec. 3-5, 45
	Cunningham, J. W.	High Conductivity Cooling Fins For Aircraft Engines	May 1, 45
	Cutrell, Lt. Col. E. A.	All-Weather Flying Facilities	Jan. 7-11, 46
	Dietrich, F. J.	Aircraft Riveting and Equipment	May 1, 45
	Doman, Carl T.	General Requirements for Helicopter Engines	Nov. 1, 45
	Draney, J. J.	Heat Recovery as Applied to the Heating and Anti-icing of Aircraft	Jan. 7-11, 46
	Eaton, D. C.	Cruising Economy By Use of Water Injection	Nov. 1, 45
	Edwards, H. K.	*Psychological Requirements for Aircraft Passenger Design	Dec. 3-5, 45
	Edwards, M. L.	Performance of the Air Oil Separator in Engine Breather Systems	April 24, 45
	Etchells, F. B. Underwood, A. F.	Silver Bearings	May 7, 45
	Field, Howard	Reduction of Vulnerability of Aircraft Hydraulic Systems	April 19, 45
	Friedlander, J. W.	Operating Costs of Personal Airplanes	May 7, 45
	Gill, John	All-Weather Flying Techniques	Jan. 7-11, 46
	Godsey, F. W., Jr.	*Gas Turbine & Aircraft	Oct. 4, 45
	Gulbransen, H. E. Capt.	Transoceanic Air Navigation	Dec. 3-5, 45
	Hanley, W. V. Hundere, A.	Economics of Airline Fuel Utilization	Nov. 1, 45
	Haver, R. L. Goodin, H. A., Jr.	Design Trends in Aircraft Exhaust Systems	Jan. 7-11, 46
	Heino, A. F.	Airport Terminal Design	Dec. 3-5, 45
	Hicks, R. D.	Service Experience with Light Aircraft Engines	May 7, 45
	Holt, R. G.	*Aircraft Accessories for 400 Cycle Motor Operation	April 24, 45
	Johnson, S., Jr.	Air Fixtures and Air Controls	Jan. 7-11, 46
	Jones, Alun R.	Airplane Icing Problem and Its Alleviation through Research	Nov. 1, 45
	Kelley, Bartram	Helicopter Stability with Young's Lifting Rotor	March 19, 45
	Kelly, R. D.	Review of Air Transport Developments in America	Jan. 7-11, 46
	Kendrick, J. B.	Applied Aero-Economics	Jan. 8-12, 45
	King, W. J.	Axial versus Centrifugal Superchargers for Aircraft Engines	May 7, 45
	Kirchner, O. E.	Foreign Observations	Jan. 7-11, 46
	Knight, J. E. Baxley, C. H.	Modern Aircraft Refueling	Oct. 4, 45
	Knight, William	Stresses in Disc Wheels	April 5-7, 44
	Landgraf, F.	Helicopter Design Problems	Nov. 1, 45
	Lingle, Col. D. G. Seitz, Capt. G. A.	Army-Navy Aeronautical Standardization	Reprinted - Nov. 42 SAE Journal
	Long, D. W. Lt. Col.	Air Transport Command Cargo Loading Experience	Dec. 3-5, 45
	Loudenslager, O. W.	Structural Model Testing	May 1, 45
	Lusk, Capt. R. J.	Protection of Electrical Systems on Military Aircraft	April 24, 45
	McFarland, F. R.	Aircraft Engine Gears	May 7, 45
	Maloy, Raymond B.	A Resume of Desirable Characteristics for Non-Stalling, Non-Spinning Airplanes	May 7, 45
	Martinez, Karl Schnitzer, S. Berry, M. M. DeCourcey, D.	*Auxiliary Power Systems for Aircraft	June 7, 45
	Messinger, B. L.	Refrigeration for Air Conditioning Pressurized Transport Aircraft	Dec. 3-5, 45
	Moreton, D. H.	Problems Involved in Airframe Lubrication	Aug. 24, 45
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	Payne, A. O.	*Fueling a Half Forgotten Bit of Aircraft Design	Oct. 4, 45
	Pigott, R. J. S.	Analysis of Positive Supercharger Losses	Nov. 14, 45
	Pigott, R. J. S.	*Various Types of Compressors for Supercharging	May 17, 45
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	Richards, A. B.	*Materials in Bomber Construction	June 15, 45
	Robinson, Ray	The Postwar Market for Personal Planes	May 7, 45
	Rodriquez, D. L.	Wartime Aircraft Service Problems – Their Solution	June 19, 45
	Rowe, M. R. Ladd, G. T.	Water Injection for Aircraft Engines	Aug. 24, 45
	Rudd, J. K. Heath, Westcott	Radio Interference and the Aircraft Engine	Oct. 5-7, 44
	Rugge, R. A.	*Fluorescent Lighting for Commercial Airplane Interiors	Dec. 3-5, 45
	Rummel, R. W.	*Aircraft Interiors from the Airline Viewpoint	Dec. 3-5, 45
	Saint, S. P.	A System Specification for Air Navigation and Traffic Control Development	Dec. 3-5, 45
	Schultz, A. B.	*Design Requirements for Pickup Aircraft	Dec. 6, 44
	Schweitzer, P. H. Sharples, L. P.	S-S System of Lubrication for Aircraft Engines	Oct. 4, 45
	Short, Mac	An Aircraft Approach to Automobile Body Design	Jan. 7-11, 46
	Stunkel, R. C.	*Some Basic Principles of Aircraft Maintenance	June 14, 45
	Sweeney, W. J. Kunc, J. F., Jr. Morris, W. E.	Aircraft Engine Induction System Deposits	Jan. 7-11, 46
	Trumbull, A. F.	*Future Aircraft Electrical Loads for Aircraft	June 7, 45
	Vanik, M. F.	*Flight Engineer Station Design and Requirements	Dec. 3-5, 45
	Weeks, W. L.	Factors in Aeration and Deaeration of Aircraft Engine Oil	Oct. 4, 45
	Wendell, E. E. Warden, H. H. Kerr, H. H.	Weight Reduction of Aircraft Braking System thru the Use of Reverse Thrust Propellers	Oct. 4, 45
	Woodyatt, D. B. Jerrems, A. W.	*An Analysis of the Fundamental Training Problems Created Within an Airline by a Transition from Two Engine to Four Engine Equipment	June 7, 45

Fuels and Lubricants

	Adams, E. W.	Performance Testing of Wheel-Bearing Lubricants	Nov. 6-7, 45
	Alspaugh, M. L.	Gasoline Gum Tolerance of Ordnance Equipment (Report of CFR Committee)	Jan. 7-11, 46
	Ambrose, H. A. Trautman, C. E.	Engine Oil Foaming	Jan. 8-12, 45
	Becker, C. F.	Gasolines – Past, Present, Future	Dec. 1, 44
	Berry, B. M. Rollins, F. S.	Aviation Lubricating Oils	Aug. 24, 45
	Best, H. W. Ainsley, W. G. Keyser, P. V. Sabina, J. R. Jeffrey, Lt.-Col. R. E.	Symposium on Fuels and Lubricants Significance of Octane Number Progress Report on Grease Projects Improved Gear Lubricants Stable Gasoline for War and Peace Heavy Duty Oils in Military Service	Jan. 17, 46
	Brabbs, Lt. A. D.	Testing Heavy-Duty Lubricating Oils for Naval Service	Nov. 9-10, 44
	Brandes, Dr. O. L. Donaldson, H. H., Jr.	Use and Evaluation of Heavy Duty Engine Oils	May 9, 45
	Brooks, D. B.	A Review of the Development of Reference Fuel Scales for Knock Rating	Jan. 7-11, 46
	Cattaneo, A. G. Bollo, F. G. Stanly, A. L.	A Petroleum Research Engineer's Outlook on Fuels for Conventionally Powered and Gas Turbine Aircraft	Aug. 24, 45
	Effmann, Karl H.	Engine Oil Consumption Determination	March 8, 45
	Galindo, Lt. Com. H. L.	Navy Experience With Diesel Fuels and Lubricants	May 17, 45
	Grieg, Com. E. F. Goddin, Lt. Com. C. S.	Significance of Cetane Number in Fuels	Nov. 6-7, 45

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____	Holaday, W. M. Mount, W. S.	Discussing the Fuels and Lubricants Supply Problem	May 15, 45
____	Kauppi, T. A. Pedersen, W. W.	Silicones as Lubricants	Nov. 6-7, 45
____	Keyser, Paul V.	Progress Report on Gear Oils Projects-CRC	Jan. 8-12, 45
____	Kratzer, J. C. Green, D. H. Williams, D. B.	New Synthetic Lubricants	Jan. 7-11, 46
____	Larson, M.	Diesel Fuel Additives Create New Concepts	Nov. 6-7, 45
____	Ronan, J. T.	Motor Oil Performance	Dec. 11, 44
____	Ryder, Earle A.	*The Valuation of Better Fuels	April 5, 45
____	Secrest, R. M.	*The Operator's Fueling Problems	Oct. 4, 45
____	Tongberg, C. O. Ellis, R. E. Baxley, C. H.	Application of Heavy Duty Additives to Aviation Oils	Nov. 6-7, 45
____	Veal, C. B.	Philosophy of Cooperative Research	Jan. 7-11, 46
____	Wolf, H. R.	Motor Oils – Regular, Premium and Heavy Duty	Jan. 7-11, 46

Miscellaneous

____	Adams, H. W. Foulon, Fred	*The Design of Electro-Mechanical Actuating Systems	June 7, 45
____	Aufmuth, R. B.	The Practice of Powder Metallurgy	March 12, 45
____	Collyer, John	Outlook for Rubber for the Automotive Industry – Synthetic and Natural	Jan. 7-11, 45
____	Dunning, Dr. J. R.	Development of Atomic Energy	Jan. 7-11, 46
____	Frye, Col. J. H.	Metallurgy of Foreign Automotive Materiel	Jan. 8-12, 45
____	Heindenreich, R. D.	*Electron Microscopic Investigations of Surface Structure	June 4, 45
____	Jackson, P. B.	Aluminum After the War	March 14, 45
____	Martz, L. S. Peden, W. T.	Latest Developments in Honing Techniques	Jan. 7-11, 46
____	McBrearty, J. F.	Utilization of New High Strength Aluminum Alloys	Oct. 4, 45
____	McCloud, J. L.	Methods of Specifying Materials	Jan. 7-11, 46
____	Miller, Roy A. Tatman, Max E.	Shop Aspects of the New High Strength Aluminum Alloys	Oct. 4, 45
____	Porter, F. P.	Methods for Calculating Torsional Vibration	Jan. 8-12, 45
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——SP-5.	EVALUATION OF EFFECTS OF TORSIONAL VIBRATION	5.00	10.00
——SP-7.	LEAF SPRING MANUAL	1.00	2.00
——SP-9.	HELICAL & SPIRAL SPRINGS MANUAL	.50	1.00
——SP-11.	VOLUTE SPRING MANUAL	1.00	2.00
——SP-11A.	SUPPLEMENT TO VOLUTE SPRING MANUAL	1.50	3.00
——SP-18.	RECLAMATION OF ENGINE VALVES	.50	1.00

——Bill me. _____
(name)

——Bill company. _____
(company)

——Check enclosed. _____
(address)

Student Branch News

Oregon State College

AT a re-activation meeting on Feb. 20 the Oregon State College SAE Student Branch elected officers and drafted plans for meetings throughout the coming school year. James F. Lewis was elected chairman of the Branch, Lyle Sage was voted vice-chairman, and Walter E. Fauerso, secretary-treasurer.

University of Oklahoma

Members of the SAE Mid-Continent Section were guests at the March 6 meeting of the University of Oklahoma SAE Branch. Arch Foster, Petroleum Publishing Co., chairman of the Mid-Continent Section, addressed the group on the advantages of SAE membership as seen by a petroleum engineer. Hollister Moore, manager, SAE Sections and Membership Division, outlined the scope and extent of the Society's activities and traced the development of SAE through its 40 years of growing service to the industry.

Massachusetts Institute of Technology

A banquet in honor of its graduating members was the Feb. 7 feature of the M.I.T. SAE Branch. Instructive entertainment was provided by a motion picture produced by Standard Oil Co. entitled "Octane Rating."

During the business meeting which followed, the following newly elected officers took office: chairman, Merwin R. Burman; vice-chairman, John R. High; secretary-treasurer, Thomas G. Zsembik; field editor, Guido J. Frassinelli. Retiring officers were given a round of applause in recognition of their able services during the past year.

Fenn College

Automotive engineers, engineering faculty men, and engineering students in the Cleveland area were guests of the Fenn SAE Club on Feb. 15 when Gordon Volkenaunt, Minneapolis-Honeywell Co., presented a paper entitled, "Electronic Applications." Mr. Volkenaunt supplemented his address with numerous demonstrations on the practical aspects of electronics.

College of the City of New York

At the Feb. 20 meeting of the CCNY SAE Student Branch, Prof. Wilford Stork, of the school's Drafting Department and also one of the Branch's faculty advisers, gave a short talk on "The Engineering Attitude." He stressed not only the need for technical proficiency, but also the ability of transmitting one's ideas and getting along with other people.

Since this was also the first meeting of the new semester, Prof. Stork explained the benefits of SAE membership to the new members.

To replace men inducted into the armed forces, Seymour Seiler was elected treasurer and Norman Rosen, field editor.

At the Feb. 27 meeting two interesting films supplied by the British Information Service were shown. One dealt with the manufacture of propellers and the other told the story of an RAF raid on Germany.

Technical Engineering

continued from p. 19

a special type of hysteresis analyzer was found. Claims were made that the Germans were on the verge of laboratory production of a synthetic rubber practically equal to natural rubber in hysteresis and heat performance.

Petroleum developments were covered by Major N. L. Klein in his paper on "German Military Fuels and Lubricants" and Major L. J. Grunder in a paper called "War Developments of the Oil Industry in Austria and Roumania."

The German oil economy for war was built around the production of fuels and lubricants from coal, Major Klein said. He described the various processes for production and for distribution. He emphasized that data obtained on development programs conducted by the Germans during the war have not yet been evaluated. However, Germany was paying particular attention to determination of engine-fuel relationships and the development of test equipment and procedures to rate fuels and lubricants in terms of service performance.

Major Grunder's report included an analysis of the natural resources of Austria, Hungary and Roumania, in terms of petroleum. This also included a detailed description of one of the underground refineries which began operations in February, 1945, in huge rooms and tunnels hollowed out of a mountain.

The road system over which German vehicles travelled was described by John W. Wheeler, of Burlington Lines, in a paper titled, "German Autobahn – Its Relations to German Industrial Economy and Traffic System Used." Prior to 1933 all roads in Germany were administered by the states and their regional departments. However, the National Socialist State created the office of Inspector General of German Roads, and a law in 1933 created the Autobahn. This road-building program contributed much to halting unemployment in the years immediately following 1933, besides providing Germany with highways for peace and war.

However, the use of the Autobahn prior to the war was not as great as the use of our roads, because of the more limited number of motor vehicles. At the end of the war the Autobahn was a depressing sight – not the highway itself, but all the bridge structures having been destroyed. The German is "an artist with TNT and dynamite," Mr. Wheeler said.

"An outstanding example of his superiority with TNT and his stupidity in general was his destruction of the fine joint highway and railway bridge over the Rhine at Wessel.

"This was a magnificent seven-span stone arch structure with about a quarter of a mile of stone arch overflow structures on the west approach. Any one of the river spans destroyed would have rendered the bridge useless to us, but he blew not only all spans over the river but many of the approach spans back on dry land.

"I might add that it was near the bridge that our troops bridged the Rhine 1254 ft wide with 40 ton capacity M-2 treadway bridge on March 24, 1945, the day of the attack, in eight hours and 45 minutes. His destruction slowed up our advancing army but momentarily, and it slowed up the reconstruction of Germany for decades. His demolished bridges in many cases stand as monuments to his stupidity."

An exhibit including Tatra and Maybach engines, the amphibious Volkswagen and various components was arranged through the courtesy of Major-Gen. G. M. Barnes, chief, Research and Development Service, Ordnance Department.

University of Wisconsin SAE Student Branch photographed at a recent meeting

Front row (left to right): T. R. Moyle, A. P. Kowalik, A. J. Schmitt, M. S. Smith, Prof. L. A. Wilson, faculty adviser, P. A. Myers, G. E. Hlavka, J. H. Thuermann, T. C. Brugger. Middle row: G A. Holloway, F. A. Dobbratz, J. M. Teskoski, D. E. Frank, J. D. Woodburn, F. R. Walker, O. K. Hunsaker, H. C. Adler. Top row: I. Chorlin, R. H. Lang, R. L. Heinrich, T. M. Amlie, G. W. Bailey, J. E. Hinkley, P. E. Tausche, D. L. Kerr, R. H. Laughlin, E. G. Brender

SAE Coming Events

Meeting	Date	City	Hotel
• Summer (Semi-Annual)	June 2-7	French Lick, Ind.	French Lick Springs
• West Coast Transportation & Maintenance	Aug. 22-24	Seattle	New Washington
• Tractor	Sept. 11-12	Milwaukee	Hotel Schroeder
• Aeronautic Meeting and Aircraft Engineering Display	Oct. 3-5	Los Angeles	The Biltmore
• Transportation & Maintenance	Oct. 16-17	Chicago	Knickerbocker
• Fuels & Lubricants	Nov. 7-8	Tulsa	Mayo
• Air Transport Engineering	Dec. 2-4	Chicago	Edgewater Beach

Buffalo – April 17

University Club; dinner 7:00 p.m. Hydraulic Torque Converters – R. Brunken, White Motor Co.

Chicago – April 9

Knickerbocker Hotel; dinner 6:45 p.m. Design and Application of Electric Brakes – J. George Oetzel, consulting engineer, Warner Electric Brake Mfg. Co.

Cincinnati – April 11

Alms Hotel; dinner 6:30 p.m. New Developments in Maintenance Since Pearl Harbor – J. E. Harvey, Pittsburgh Motor Coach Co.

Cleveland – April 8

Carter Hotel; dinner 6:30 p.m. Aeronautical Activities Meeting. Our Air-Sea Navy – Vice Admiral P. N. L. Bellinger, General Board, Navy Department.

Detroit – April 1, 8 and 22

April 1 – Commodore Perry Hotel, Toledo; dinner 7:00 p.m. Economic Forces and their Influence on the Automobile Industry – James D. Mooney, chairman of the board, Willys-Overland Motors, Inc. Toastmaster – D. G. Roos, Willys-Overland Motors, Inc. Motion Picture – Speeding Up.

April 8 – Horace H. Rackham Educational Memorial Bldg., meeting 7:30 p.m. Plastic Vehicle Bodies – Gene Vidal, president, Vidal Corp. Discussers: A. W. Koon, Columbian Rope Co. – Co-Ro-Lite. R. J. Metzler, Hercules Powder Co. – Thermoplastic Laminates. C. B. Hemming and O. S. Tuttle, U. S. Plywood Corp.

April 22 – Statler Hotel; dinner 6:30 p.m. Speaker: Ernest T. Weir, chairman of the board, National Steel Corp. Subject to be announced. Toastmaster – M. E. Coyle, Chevrolet Motor Division.

Indiana – April 11

Antlers Hotel, Indianapolis; dinner 6:45 p.m. Future Use of Rubber by the Automotive Industry – E. Waldo Stein, engineer, Firestone Tire & Rubber Co.

Metropolitan – April 11

Pennsylvania Hotel, New York; meeting 7:45 p.m. Engine and Fuel Requirements for Future Buses and Trucks – Robert Cass, assistant to the president, White Motor Co.

Milwaukee – April 5

Milwaukee Athletic Club; dinner 6:30 p.m. The Courage of Research – William B. Stout, director of research, Stout Research Division, Consolidated Vultee Aircraft Corp.

Northern California – April 9

Aeronautical Meeting through NACA Wind Tunnel, Moffatt Field. Inspection of Jet Engines and Planes – 4:00 to 6:30 p.m. Dinner 6:30 p.m.

Northwest – April 5

Gowman Hotel, Seattle; dinner 7:00 p.m. Principles of Air Brake Operation – S. Johnson, Jr., engineering representative, Bendix-Westinghouse Air Brake Co. Sound Motion Picture Film.

Oregon – April 12

Imperial Hotel, Portland; dinner 7:00 p.m. Westinghouse Air Brakes – S. Johnson, Jr., engineering representative, Bendix-Westinghouse Air Brake Co.

Peoria – April 29

Jefferson Hotel; dinner 6:30 p.m. Speaker – A. W. Herrington, Marmon-Herrington Co., Inc. Subject to be announced.

Pittsburgh – April 25

University Club; Annual Anniversary Meeting. All day event – morning, afternoon and evening sessions.

St. Louis – April 18

Congress Hotel; dinner 6:30 p.m Technical Writing and Engineering Presentations – T. O. Richards, General Motors Corp., Research Laboratories.

Southern California – April 5 and 19

April 5 – Education Bldg., U.C.L.A., Westwood; meeting 8:00 p.m. Diesel Development and Application in Germany – Professor Carl J. Vogt, University of California. Technical Chairman – L. M. K. Boelter.

April 19 – Biltmore Hotel, Los Angeles; meeting 8:00 p.m. Application of Rocket Power to Scheduled Air Line Operations – Elmer E. Nelson, chief test pilot, director of sales, Aerojet Engineering Co. Technical Chairman – Richard S. Orchard.

Spokane Group – April 9

Desert Hotel; dinner 7:00 p.m. Speaker and subject to be announced.

Texas – April 19

Blackstone Hotel, Fort Worth; Automotive Transportation and Maintenance Meeting.

Virginia Group – April 11

William Byrd Hotel; dinner 7:00 p.m. Future Automotive Possibilities – Austin Wolf, automotive consultant.

Western Michigan – April 18

Occidental Hotel, Muskegon; meeting 7:45 p.m. Gas Turbines – Dr. J. T. Rettaliata, Allis-Chalmers Mfg. Co.

Probabilities

cont. from p. 28

this respect. It is estimated that not more than 20% of the machine shops, except those machining high precision parts, manufacture products that are within their own engineering tolerances.

Tolerances can be selected by scientific methods. First, a probability, or chance to take, must be chosen for which tolerances will be exceeded and parts either returned for rework or rejected. The cost department is vitally interested in this condition. Second, the performance of machine tools must be ascertained by determining the standard deviations. This is the production department's problem. Third, the engineering department determines the minimum and maximum clearances which can be used with satisfactory operation still achieved.

Tolerances selected by the theory of probabilities are more liberal, yet do not exceed the dimensions of parts already installed in engines which have operated successfully. There has been no sacrifice of quality, in fact the quality will undoubtedly be improved because the production, engineering, and cost departments are all in agreement.

There is no argument against the fact that more liberal tolerances will lower the cost of production, and therefore result in considerable savings to the engine manufacturer.

turn to p. 50

About Society Members

Automobile Manufacturers Elect Officers

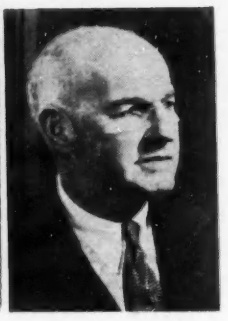
President

George W. Mason

Treasurer

George Christopher

Retired



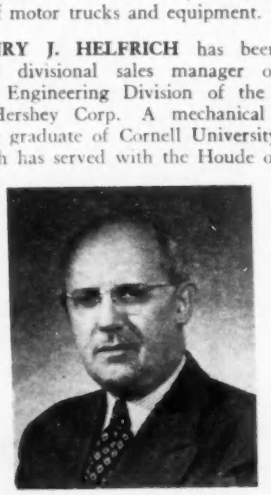
Alvan Macauley

GEORGE W. MASON, president, Nash-Kelvinator Corp., was elected president of the Automobile Manufacturers Association Feb. 27, to succeed Alvan Macauley, chairman of Packard Motor Car Co., who resigned after an 18-year tenure. George Christopher, president of Packard Motor Car Co., was elected treasurer, to succeed Mr. Mason. Other officers of the AMA are Paul G. Hoffman, president, Studebaker Corp., and Robert F. Black, president, White Motor Co., vice-presidents; Albert Bradley, executive vice-president, General Motors Corp., secretary; and George Romney, general manager. Messrs. Macauley, Hoffman, Black, and Romney are SAE members.

G. E. CHESS is now associated with Johnson Bros. of Fresno, Calif. He was previously illuminating engineer with the Pacific Gas & Electric Co., same city.

C. L. BROSSEAU, for many years associated with Mack-International Motor Truck Corp., resigned recently to become secretary-treasurer of the newly organized McCarty-Brosseau Motor Co. of Tulsa, Okla., distributors of motor trucks and equipment.

HENRY J. HELFRICH has been appointed divisional sales manager of the Houde Engineering Division of the Houdaille-Hershey Corp. A mechanical engineering graduate of Cornell University, Mr. Helfrich has served with the Houde organi-



Henry J. Helfrich

zation since 1938 in the engineering and sales departments. For two years he was plant engineer. During the past three years he has collaborated with engineering staffs in the railroad, aviation, and automotive industries in developing hydraulic instruments for vibration and ride control. From 1920 to 1934 Mr. Helfrich was a member of the engineering staff of the Pierce-Arrow Motor Car Co. For four subsequent years he was development engineer for the Truck Equipment Corp.

WALTER A. PARRISH has been appointed general manager of the Indian Motorcycle Co., Springfield, Mass., and will continue in his post as chief engineer of Rogers Diesel & Aircraft Corp., New York. The motorcycle firm is now controlled by the New York concern. **E. PAUL du PONT** remains on the board of directors. Mr. Parrish is a past vice-president of the Society.

MERTON J. STEVENS, formerly assistant superintendent, Bell Aircraft Corp., is now process engineer with Kaiser-Frazer Corp., Willow Run, Mich.

Formerly in the engineering design and layout department of the Detroit Transmission Division of General Motors Corp., **JOSEPH MACK II** is now serving in the Automotive Division of Timken Roller Bearing Co., Detroit.

Previously assistant director of mechanical engineering, British Army, England, **D. G. STOKES** is now export development manager of Leyland Motors, Ltd., Leyland, Lancashire, England.

Formerly a consulting engineer, **EMMANUEL PIRONNEAU** is now vice-president of Technical and Trading Organization, Inc., New York City.

A. L. RICHARDS has recently joined Ruston and Hornsby, Ltd., Lincoln, England, as engineer in charge of locomotives.

Formerly assistant section engineer, Detroit Diesel Engine Division, General Motors Corp., **PAUL M. CLAYTON** is now engine development engineer with Reo Motors, Inc., Lansing, Mich.

NORMAN L. WUERZ has been named chief metallurgist of the Special Products Division of Thompson Products, Inc., Cleveland. He was formerly a metallurgist with the same company.

NORMAN DAMON, vice-president, Automotive Safety Foundation, has been elected chairman of the National Committee for Motor Vehicle Fleet Supervisor Training at the annual meeting of the committee held in Washington on Jan. 18. **CHARLES G. MORGAN, JR.,** American Trucking Associations, Inc., was elected chairman of the Promotion & Scheduling Committee, and **J. WILLARD LORD,** Atlantic Refining Co., was elected chairman of the Program & Standards Committee of the NCMVFST.

LT.-COL. HORACE R. HIGGINS, Ordnance Department, has recently returned from a tour of duty in the Philippines and is now on terminal leave. Colonel Higgins is a past-chairman of SAE Washington Section.

MARVIN STERN, who had previously been stress analyst with Ranger Aircraft Engines, division of Fairchild Engine & Airplane Corp., Farmingdale, L. I., N. Y., is now affiliated with Lockheed Aircraft Corp., Burbank, Calif.

Formerly associated with the Marmon-Herrington Co., Inc., Indianapolis, Ind., **WALTER J. MITCHELL** is now connected with the Automotive Products Co., London, England.

JAMES HOLAN has been elected chairman of the board of the American Coach & Body Co., Cleveland. Starting 35 years ago with a small wagon repair shop, Mr. Holan built up his business until, in 1922, the company adopted its present name and broadened its field with the manufacture of wood truck bodies for telephone and power companies. The firm soon became engaged in the then new automotive metal-working field. From 1926 to the entrance of the United States into World War II, the organization's activities were directed exclusively to the design and manufacture of steel bodies and line construction and maintenance equipment for the public utilities. With the start of the war, American turned to the production of equipment for the various military services.

James Holan

SAE Members . . .

A. W. PHILLIPS has recently become associated with the General Tire & Rubber Co., Akron, Ohio. He was formerly general superintendent in the Tire Division of the B. F. Goodrich Co., same city.

L. W. CHAPIN has recently joined the Ohio Oil Co., Findlay, Ohio, as sales analyst.

WEBSTER H. FRANCIS, JR., has been appointed vice-president of H. H. Sullivan, Inc., of Rochester, N. Y. He was previously vice-president and secretary of the Evans-Francis Corp., Baltimore, Md.

Formerly factory manager, Lockheed Aircraft Corp., Dallas, Tex., WALTER M. JOHNSON is now affiliated with Hal Roach Studios, Inc., Culver City, Calif.

N. E. ALEXANDER is now civilian instruments engineer at the Dugway Proving Ground, Tooele, Utah. He was formerly chief of the Instrument Division, Allegany Ballistics Laboratory, Cumberland, Md.

Previously assistant sales manager, Lord Mfg. Co., Erie, Pa., JOHN M. LOGAN is now sales engineer in the structural rubber products department of the Mechanical Goods Division of the U. S. Rubber Co., Detroit.

S. BERTRAND BARNARD, consulting engineer, specializing in new product development and patents, has moved his offices to 29-28 41 Ave., Long Island City, N. Y. He is an associate editor of the SAE Metropolitan Section *Accelerator*.

CLARENCE E. DAVIES, secretary, ASME, has been appointed to head the American delegation to the International Technical Congress which will meet in September in Paris as the first world meeting of scientists to study the problem of atomic energy. Chairman Aristide Antoine of the new ITC said in France that the organization would become a clearing house for all new information and techniques on scientific aspects

Clarence E. Davies

of science and industry. Mr. Davies recently returned to New York after three years of service as a colonel in the Army Ordnance Department.

WALTER W. CARLSON has recently been named vice-president in charge of sales of the Liberty Trucks & Parts Co., Denver, Colo. Mr. Carlson has served as sales manager with the same company for the last 12 years.

ROY W. PATON has recently joined the engineering department of the Champion Spark Plug Co., Toledo, Ohio. He was formerly project engineer with the Perfect Circle Co., Hagerstown, Ind.

Formerly works manager, machine shop, American Stock Gear Division, American Gear & Mfg. Co., Chicago, N. A. KLIPPER is now purchasing agent with the Chicago branch of the same company.

Formerly service representative, General Motors of Canada, Ltd., Oshawa, Ont., S. H. PASTON is now sales and service manager of Beny Motors, Ltd., Alta., Canada.

CARL H. KINDL, formerly senior vice-president of the National Cash Register Co., has been named vice-president in charge of manufacturing for the Aviation Corp. and its associated companies. Mr. Kindl has been

Carl H. Kindl

associated with Westinghouse Electric Corp., and was general manager of the Delco Products Division of General Motors Corp. He will make his headquarters at Detroit.

Formerly chief experimental engineer, R. B. McINTYRE is now chief of aerodynamics of De Havilland Aircraft of Canada, Ltd., Toronto, Ont., Canada.

C. HERBERT BAXLEY, vice-president of Intava, Inc., has left for a business trip in Europe, planning to visit London, Paris, The Hague, Copenhagen, Oslo, Stockholm, and other centers in connection with making arrangements to supply aviation fuels and lubricants for operators of U. S. air transport companies at their respective overseas terminals. Mr. Baxley is a former treasurer and vice-chairman of SAE Metropolitan Section.

EDMUND GIFFEN is now professor of civil and mechanical engineering, Queen Mary College (University of London), London, England. He was formerly director of research, Institute of Automobile Engineers, Brentford, Middlesex.

Benson Ford

BENSON FORD, a director of Ford Motor Co., has rejoined Ford after serving for more than three years in the U. S. Army. The announcement, made by HENRY FORD II, president, added that Benson Ford will soon take over an executive assignment. A few months after Mr. Ford entered the Army in October, 1942, he was transferred to Officers' Candidate School in Fargo, N. D., and received his commission as a second lieutenant in August, 1943. In January, 1945, he was promoted to the rank of captain. Prior to joining the Army, Mr. Ford worked in the purchasing department and the supercharger division of the company.

EDMOND E. BISSON has been named head of the lubrication, friction, and wear research section of the National Advisory Committee for Aeronautics, Aircraft Engine Research Laboratory, Cleveland. He was formerly research mechanical engineer and head of the piston ring and cylinder barrel research section of the same organization.

EDWARD C. HOENICKE, general manager of the Foundry Division of the Eaton Mfg. Co., has been appointed a member of the Gray Iron Foundry Industry Advisory Committee to the Army Industrial College, Washington, D C. During the war period, Mr. Hoenicke organized this Advisory Committee for the War Production Board, serving as the first head of the Gray Iron Castings Section.

MAURICE P. WHITNEY has been appointed acting general manager of the Eclipse Machine Division of Bendix Aviation Corp., to succeed T. W. TINKHAM, who has recently resigned. As a member of the Eclipse Machine Division's engineering staff for the past 26 years, Mr. Whitney played an important role in the development of Bendix starter drives and other automotive and bicycle components which are the plant's peacetime products. He directed the division's expanded engineering activities which were necessary to meet unprecedented wartime demands for high-precision mass pro-

E. Q. Beckwith

Doyle D. Buttolph

E. Q. BECKWITH and **DOYLE D. BUTTOLPH** have returned to Phillips Petroleum Co., Bartlesville, Okla., as manager of the product supply division, Chemical Products Department, and assistant manager of the mechanical equipment division, Chemical Engineering Department, respectively. Major Beckwith, who has served for three and one-half years in the Army, was, at the time of his discharge, chief of the Production Service Branch of the Cleveland Ordnance District. Joining the Army as a first lieutenant in the Office of the Chief of Ordnance, Washington, D. C., he was later transferred to Toledo, Ohio, as field service representative at the Tank Depot. He was subsequently appointed commanding officer of the Tank Depot at Lima, Ohio. Captain Buttolph has been serving with Ordnance at the Aberdeen Proving Ground, Md., doing research and development work on all types of combat and transport vehicles. For over two years, he was in charge of the Automotive Maintenance and Development Shop. He joined the Army as a second lieutenant in March, 1942, and was promoted to the rank of captain in May, 1944.

duction of mechanical time fuses, projectiles, aircraft magnetoes, and direct fuel injection pumps.

FRED E. WEICK, vice-president of the Engineering & Research Corp. of Riverdale, Md., and designer of the Ercoupe "spinproof" monoplane, received the 1945 Fawcett Aviation Award in a ceremony broadcast as a part of the "We, the People" Feb. 18 program. The award, consisting of a trophy and $1000 given annually to the person who has "made the greatest scientific contribution to the advancement of aviation," was presented to Mr. Weick by **CAPT. EDWARD V. RICKENBACKER,** president and general manager of Eastern Air Lines, Inc. In addition to the first-place award given to Mr. Weick, an honor award was also presented to **HALL L. HIBBARD,** chief of Lockheed Aircraft Corp.

Formerly a student member at Fenn College, Cleveland, **GEORGE H. ECKELS** is now automotive engineer with the Department of Water & Power of the City of Los Angeles, Calif.

P. D. WELCH has recently joined the Truck Division of the Studebaker Corp. as merchandising director. He was formerly a lieutenant (aviation volunteer, specialist) in the USNR, serving as transportation officer at the U. S. Naval Air Station, Cocoa, Fla.

ERWIN E. PERSO has been named supervising engineer in the Los Angeles Basin for The Texas Co. Lubrication engineer in the Oregon branch of The Texas Co. for 17 years, Mr. Perso spent two years with the Colorado Fuel & Iron Corp. before joining the Texas organization. **J. L. PHELPS** has been named lubrication engineer, succeeding Mr. Perso.

Formerly associated with the Dodge Chicago Plant, division of the Chrysler Corp., **WILFRED E. BETTONEY** is now test engineer in the Automotive and Aircraft Laboratory of Universal Oil Products Co., Riverside, Ill.

IRWIN A. BINDER is now factory manager of the Valve & Jet Division of Thompson Aircraft Products Co., Euclid, Ohio. He was formerly chief of the Metallurgical and Chemical Laboratories of the same company.

HAROLD BARKAN is now associated with the Colgate-Palmolive-Peet Co., Jersey City, N. J., as a mechanical engineer. He was previously procurement inspector, USAAF, c/o Wright Aeronautical Corp., Woodridge, N. J.

ARTHUR E. RAYMOND, vice-president of engineering for Douglas Aircraft Co., Inc., Santa Monica, Calif., has been elected 1946 president of the Institute of the Aeronautical Sciences, succeeding **CHARLES H. COLVIN,** New York engineering consultant, retiring president. A graduate of Harvard University in 1920, Mr. Raymond joined the Douglas organization in 1925. He soon became assistant chief engineer, chief engineer, and in 1939, was appointed vice-president of engineering. After receiving his M.S. in aeronautical engineering at M.I.T., he joined

Arthur E. Raymond

C.I.T. as assistant professor of aeronautics. Active in SAE standardization work as vice-chairman of the SAE Aeronautical Division during the war period, Hr. Raymond is serving as 1946-1947 SAE Councilor.

G. G. C. SCHARFF has become senior layout man with Chevrolet Motor Division, General Motors Corp., central office. He was a designer with the Superior Engine Division of the National Supply Co., Springfield, Ohio.

J. E. BATCHELOR, Associated Ethyl Co., Ltd., has been named technical officer and is making his headquarters at Melbourne, Australia. He was formerly chief representative for the same company for Australia and New Zealand.

W. P. SANSOM is now associated with Canadair, Ltd., Montreal, Que., Canada. He was formerly chief mechanic, Vancouver Station, Trans-Canada Air Lines.

Formerly professional engineer with Douglas Aircraft Co., Inc., Santa Monica, Calif., **JAMES M. SMITH** is now hydraulic engineer with the Byron Jackson Co., Los Angeles.

JAMES W. MASSEY is now associated with Beech Aircraft Corp., Wichita, Kans., as powerplant test engineer. He was formerly service engineer with the Lycoming Division of the Aviation Corp.

DAVID C. PRINCE, vice-president, General Engineering and Consulting Laboratory, General Electric Co., Schenectady, N. Y., has been awarded the 1945 Lamme Medal of the American Institute of Electrical Engineers "for his distinguished work in the development of high voltage switching equipment and electronic converters."

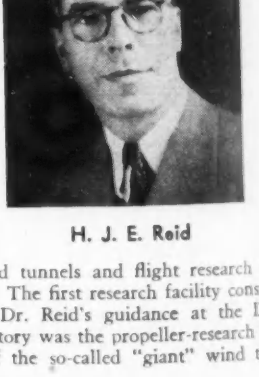
Formerly associated with Buick Motor Division, General Motors Corp., Melrose Park, Ill., as a tool inspector in charge of model test engine measurements, **FRANCIS W. MURPHY** is now a gage inspector with Western Electric Co., Chicago.

WILLIAM P. YOUNGCLAUS, JR., who had been lubrication foreman, Dodge Chicago Plant, division of the Chrysler Corp., is now district sales engineer, Flexpansion Corp., Chicago.

Previously associate mechanical engineer and verification test supervisor, USAAF, Aircraft Technical Service Command, Eastern Procurement District, New York, **THOMAS F. REINHARDT** is now installations engineer with Bell Aircraft Corp., Niagara Falls, N. Y.

GEORGE K. DREHER has been named vice-president in charge of manufacturing of Ampco Metal, Inc., Milwaukee, Wis. Mr. Dreher also retains his former duties as works manager of the firm.

H. J. E. REID, of the National Advisory Committee for Aeronautics, received an honorary degree as doctor of engineering at recent commencement exercises at Worcester Polytechnic Institute in recognition of his pioneer work in the design and operation



H. J. E. Reid

of wind tunnels and flight research instruments. The first research facility constructed under Dr. Reid's guidance at the Langley Laboratory was the propeller-research tunnel, first of the so-called "giant" wind tunnels.

JOHN F. CREAMER, general manager of Wheels, Inc., New York City, has been elected president of the National Wheel and Rim Association. Mr. Creamer is a past-chairman of SAE Metropolitan Section.

Formerly associated with the Nemco Electric Co., Engine Heater Division, Seattle, Wash., C. M. KIMBERLIN is now motor heating engineer with the Columbia Electric & Mfg. Co., Manufacturing Division, Spokane, Wash.

MANVANTRAI D. MEHTA is now managing director of the Motor House (Gujarat), Ltd., Ahmedabad-India. He was formerly general manager of Hindustan Motors, Ltd., Calcutta, India.

Formerly supervisor of fleet operations of the Virginia Electric & Power Co., Richmond, Va., CHARLES W. WOOD is now assistant to the manager of the motor vehicle department of the same company.

Formerly an engineer and staff officer (Policy and Plans), Royal Air Force, MAJOR STEPHEN BLUMENTHAL is now on the staff of the Ministry of Supply and Aircraft Production, Directorate of Repair and Maintenance, as assistant director of planning.

JOSEF K. HOENIG is now installation engineer with the Propeller Division of Curtiss-Wright Corp., Caldwell, N. J. He was formerly senior mechanical engineer with Packard Motor Car Co., Toledo, Ohio.

Previously factory manager, Her Majesty Underwear Co., Leola, Pa., J. H. BOUMAN is now industrial relations representative with the Ansco Division of the General Aniline & Film Corp., Binghamton, N. Y.

J. E. HIGGINS has been elected president of Truck Specialties Co., Harrisburg, Pa. He was formerly vice-president of the Autocar Sales & Service Co., Philadelphia.

Formerly engineering draftsman, Consolidated Vultee Aircraft Corp., San Diego, Calif., W. L. SULLINS is now serving in a similar capacity with Ryan Aeronautical Co., same city.

BURTON W. ELGIN has been appointed New York regional sales manager for the automotive divisions of Kaiser-Frazer and Graham-Paige Motors corporations. Recently transferred to inactive status in the regular Army reserve corps with the rank of major, Mr. Elgin served four years with the Eighth Air Force. Before entering the service, he was associated with the Firestone Tire &

Burton W. Elgin

Rubber Co. as manufacturer's representative, and with the Firestone Aircraft Co. He was also a regional manager and manager of the National Fleet Sales Division of Dodge Bros. Corp.

MELVIN N. LEFLER, who had been design checker with Lockheed Aircraft Corp., Burbank, Calif., has recently joined Menasco Mfg. Co., same city, as design engineer.

W. F. LOGEMANN has been named chief engineer of the Brown Steel Tank Co, Minneapolis, Minn. He was formerly assistant engineer with International Harvester Co., Chicago.

R. C. LOOMIS is now director of base engineering, Transcontinental & Western Air, Inc., Kansas City, Mo. He was formerly superintendent of flight research with the same organization.

Formerly liaison engineer, Murray Corp. of America, Detroit, HARVEY J. ANSCHUETZ is now layout man and checker with Detroit Sales Engineering.

FRANK G. BACKMAN has been named general manager of the Midwest Service & Supply Co., Salt Lake City, Utah. He was formerly shop foreman with Koepsel & Love, same city.

RICHARD ARNOLD, who had formerly been production engineer with the Columbia Electric Mfg. Co., Cleveland, is now research engineer with the Cleveland Graphite Bronze Co.

HARRY R. GREENLEE has been named chief engineer of the L.G.S. Spring Clutch

Harry R. Greenlee

Corp., Indianapolis, Ind. He was formerly assistant chief engineer of the same company.

Formerly in the liaison engineering department of Douglas Aircraft Co., Inc., Long Beach, Calif., RALPH C. FLUGEL is now associated with the J. O. Mfg. Co., Southgate, Calif.

CARMEN S. STRA, who had been superintendent of the Atlantic Diesel Corp., New Brunswick, N. J., is now serving in a similar capacity with the Flako Products Corp., Milltown, N. J.

GEORGE H. STRAM is now product designer with Clark-Babbitt Engineering Associates, Inc., Newark, N. J., engineering consultants. He was formerly design checker with Lawrance Aeronautical Corp., Linden, N. J.

Formerly project engineer, M. H. KAPPS is now head of the project engineering section of the Detroit Diesel Engine Division of General Motors Corp.

SHOU CHIN WANG has been appointed chairman of the Chinese Supply Commission, Washington, D. C. He was formerly chief of the industrial and mining department of the same organization.

GORDON D. BROWN has been elected a vice-president of Bankers Trust Co. of New York City. Associated with the aviation industry for over 20 years and with Douglas

Gordon D. Brown

Aircraft Co., Inc., in production, engineering, and sales, he will head up the bank's aviation service. For nine years, Mr. Brown was in the engineering department of Douglas with responsibility for airplane specifications and contract provisions. When Douglas became active in the air transport field, Mr. Brown was transferred to the sales department, and as domestic sales manager supervised military transport sales, including the first tank- and jeep-carrying project. He later served as assistant to Donald Douglas, president, as director of market research and economic planning.

Formerly a student member at Purdue University, West Lafayette, Ind., JOHN C. GILL is now an ensign (D)L in the U. S. Naval Reserve.

WILLIAM A. MARSHALL, who had been a student member at Yale University, New Haven, Conn., is now an ensign in the U. S. Naval Reserve.

Previously senior development engineer, Goodyear Aircraft Corp., Akron, Ohio, BRITT M. SMITH is now an engineering consultant with offices in Portland, Ore.

P. H. RICHARDSON has recently joined the Marine Division of Bendix Aviation Corp., Norwood, Mass., as project engineer in charge of the engineering of the marine engines (outboard motors and small inboard engines) produced by the division. He was formerly senior project engineer with Ranger Aircraft Engines, division of Fairchild Engine & Airplane Corp.

J. C. MAILLARD has joined Transervice, Inc., New York City, exporters and importers, as vice-president in charge of the technical department. He was formerly general manager of Norex Industrial Agencies, Inc., same city.

GEORGE H. CHERRY, for many years associated with the American Bosch Corp., has joined the Anderson Co., Gary, Ind., manufacturers of windshield wiper arms and blades. He will make his headquarters in the Fisher Building, Detroit.

Formerly in the technical advisory service department of the Rome, N. Y., branch of Revere Copper & Brass, Inc., E. C. CURTIS, JR., is now assistant technical adviser in the New Bedford, Mass., division of the same firm.

Formerly a project engineer with Thompson Products, Inc., Cleveland, ROBERT E. WILLISON joined the U. S. Maritime Service in January, 1945, and has since traveled to Antwerp, Belgium; Alexandria, Egypt;

Marseilles, France; the Philippine Islands; Okinawa, and Japan. He returned to the United States in January, 1946, and is at present eligible for a marine engineer's license of second assistant engineer.

HERMAN P. SCHADE has been named to head the newly organized Automotive

Herman P. Schade

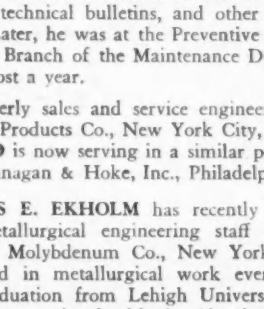
Division of the Grote Mfg. Co. Mr. Schade was formerly vice-president and general sales manager of the Arrow Safety Devices Co.

WILLIAM H. ROWE has been named administrative assistant to the assistant director of operations of the General Chemical Co., New York City.

MAJOR ROBERT W. HOGAN, U. S. Army, is now on terminal leave after serving since November, 1942, with the Ordnance Department. Entering the Army as a captain, Major Hogan is now located in Washington, D. C., representing the Ethyl Corp. He served for more than two years with the Maintenance Division of the Tank-Automotive Center at Detroit, supervising the preparation of field service modification work orders, technical bulletins, and other directives. Later, he was at the Preventive Maintenance Branch of the Maintenance Division for almost a year.

Formerly sales and service engineer with Electro Products Co., New York City, **A. A. GATTO** is now serving in a similar position with Lanagan & Hoke, Inc., Philadelphia.

LARS E. EKHOLM has recently joined the metallurgical engineering staff of the Climax Molybdenum Co., New York City. Involved in metallurgical work ever since his graduation from Lehigh University, he has been associated with the Aluminum Co. of America, Harrisburg Steel Corp., Henry Disston & Sons, Inc., and for the last seven



Lars E. Ekholm

years has been metallurgical engineer for the Alan Wood Steel Co., Conshohocken, Pa. Mr. Ekholm is a member of the executive committee of the Iron and Steel Division of the SAE Standards Committee.

Formerly head of hydraulic research, Curtiss-Wright Corp., Research Laboratory, Checktowaga, N. Y., **VERNE P. DONNER** is now development engineer in charge of the hydraulic department of the Mid-Continent Metal Products Co., Chicago.

LT. (jg) WILLIAM H. ELGAR, USNR, has recently returned from the Pacific area and has been attached to the Naval Hospital at Sampson, N. Y., as a patient. Before joining the Navy in 1941, Lieutenant Elgar was associated with the Sun Oil Co., Newark, N. J. At present on military leave from the Sun Oil organization, he will resume his activities with the company as soon as he receives his discharge from the service.

F. B. JOHNSON, preliminary design engineer with Lockheed Aircraft Corp., Burbank, Calif., was injured early in February in the crash of a small Lockheed experimental airplane which failed to clear a fence near Lockheed Air Terminal. Mr. Johnson was taken to St. Joseph's Hospital in Burbank, suffering from severe shock and other injuries.

WARREN C. LANDIS will soon join the Lubricants Department of the Shell Oil Co., Inc., New York City. Until recently a lieutenant-colonel with Army Ordnance, he served for two years as chief of the Fuels and Lubricants Branch of Field Service,

Warren C. Landis

where he was concerned with the selection and application of fuels and lubricants for Ordnance materiel. During the last four years, he worked very closely with the various SAE committees which assisted Ordnance.

CASIMIR S. KOPEC has recently joined Ford Motor Co., Automotive Research Division, West Dearborn, Mich.

Formerly mechanical adviser, U. S. Army, Corps of Engineers, Columbus, Ohio, **RAYMOND H. KRAUSE** is now associated with Harnischfeger Corp., Diesel Engine Division, Port Washington, Wis., as process engineer.

JOSEPH G. MALONEY, who had formerly been research engineer with Wright Aeronautical Corp., Paterson, N. J., is now associate engineer in the research department of Boeing Aircraft Co., Seattle, Wash.

Formerly development engineer, Ranger Aircraft Engines, division of Fairchild Engine & Airplane Corp., **RALPH S. WHITE** is now a consultant with the War Assets Corp., Washington, D. C.

E. S. HERMAN is now industrial engineer with the Harman Equipment Co., Los Angeles. He was formerly manufacturing engineer in the equipment design and procurement department of Lockheed Aircraft Corp., Factory A-1, Burbank, Calif.

Formerly quality engineer with Ranger Aircraft Engines, Farmingdale, L. I., N. Y., **HERBERT GRUNDMAN** is now quality control engineer with Specialties, Inc., Syosset, L. I.

LYLE E. CALKINS has been appointed head of the chemical laboratories of Willys-Overland Motors, Inc. Prior to joining Willys

Lyle E. Calkins

in 1943, Mr. Calkins was chief chemist of Libbey Glass Co., and earlier held the same position with the Liquid Cool Engine Division of American Aviation.

Formerly a major in the Canadian Army, **A. S. OLVER** has recently joined Imperial Oil, Ltd., Toronto, Ont., Canada.

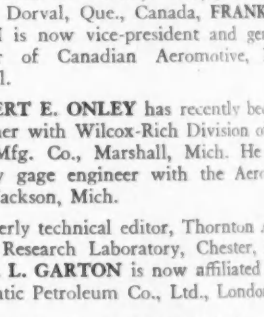
T. N. L. PUGHE, after serving for two years as British liaison representative with Packard Motor Car Co. in Detroit, has returned to England where he is a Government inspector with D. Napier & Son, Walton, Liverpool.

Formerly operations engineer with the British Overseas Airways Corp., Montreal Airport, Dorval, Que., Canada, **FRANK M. BOOTH** is now vice-president and general manager of Canadian Aeromotive, Ltd., Montreal.

ROBERT E. ONLEY has recently become a designer with Wilcox-Rich Division of the Eaton Mfg. Co., Marshall, Mich. He was formerly gage engineer with the Aeroquip Corp., Jackson, Mich.

Formerly technical editor, Thornton Aero-Engine Research Laboratory, Chester, England, **F. L. GARTON** is now affiliated with the Asiatic Petroleum Co., Ltd., London.

RICHARD H. VALENTINE has been named sales engineer in charge of the Cleve-



Richard H. Valentine

land office of the New Departure Division of General Motors Corp., Bristol, Conn. Mr. Valentine was formerly an engineer working on ball bearing application with the same company in Detroit.

PAUL G. WELLENKAMP is now manufacturing manager of the Engine Division of the Viking Tool & Machine Corp., Belleville, N. J. He was formerly engineering operations manager, Ranger Aircraft Engines, division of Fairchild Engine & Airplane Corp., Farmingdale, L. I., N. Y.

Formerly technical officer, Army Engineering Design Branch, Department of Munitions & Supply, Ottawa, Ont., Canada, **H. C. WHITE** is now regional supervisor, motor vehicle equipment, Sun Oil Co., Ltd., Toronto, Ont.

Previously senior process man, Buick Motor Division, General Motors Corp., Melrose Park, Ill., **JOHN R. HERRON** has recently joined Zenith Radio Corp., Chicago, as assistant master mechanic.

Formerly in the layout and design department, Ranger Aircraft Engines, division of Fairchild Engine & Airplane Corp., Farmingdale, L. I., N. Y., **EDWARD VAIVODA** is now machine designer with Walter Dorwin Teague, New York City.

L. E. MILES, who had been chief draftsman with the Aireon Mfg. Corp., Burbank, Calif., is now project engineer with the Booth Mfg. Corp., same city.

Previously in the product design department of the Budd Wheel Co., Detroit, **CALVIN F. POWERS** is now senior layout draftsman with the Fisher Body Division of General Motors Corp., Central Engineering Office, Detroit.

WILLIAM W. THOMSON is now affiliated with Dymaxion Dwelling Machines, Inc., Wichita, Kans., as experimental engine draftsman.

Formerly factory representative, **G. F. PETERSON** is now sales and technical representative, General Motors South African, Ltd, Port Elizabeth, South Africa.

W. F. BUNSEN is now service manager and partner of the Waldman Motor Co., La Jolla, Calif. He was formerly powerplant design engineer with Ryan Aeronautical Co., San Diego.

Formerly superintendent, Heinz and Munschauer, Cleveland, **H. MAYNARD SNOW** is now associated with the Cab Service & Parts Corp., New York City.

H. G. SEAMANS, who had formerly been in the engineering department of the Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., is now metallurgist in the Central Specialties Division of King Seeley Co., Ypsilanti, Mich.

Previously general superintendent, York Arsenals, Ltd., Toronto, Ont., Canada, **KENNETH L. MORRIS** is now serving in a similar capacity with Canada Wire & Cable Co., Ltd., same city.

Formerly chief engineer of Bendix-Westinghouse Automotive Air Brake Co., Elyria, Ohio, **ARTHUR R. LEUKHARDT** has now become eastern regional manager of the same company with offices in New York City.

ALEXANDER KURTI has recently joined Pratt & Whitney Aircraft, Division of United Aircraft Corp., East Hartford, Conn., as design engineer. He was formerly project engineer with the Autoyre Co., Oakville, Conn.

Formerly in the design analysis department of Packard Motor Car Co., Detroit, **JAMES KNOWLES** is now project engineer with Ford Motor Co., Dearborn, Mich.

Previously assistant customer engineer, Bendix Products Division, Bendix Aviation Corp., South Bend, Ind., **G. J. KENALEY** is now a private in the U. S. Army and is stationed at Camp Lee, Va.

FRANK H. HIGHLEY is now an engineer with the Keramos Co. of Canton, Ohio. He was formerly chief engineer of the spark plug engineering laboratory of the Firestone Rubber & Metal Products Co. of Wyandotte, Mich.

Formerly project engineer, **E. A. BONIFACE, JR.**, is now assistant director of aircraft engineering with American Airlines, Inc., LaGuardia Field, Jackson Heights, N. Y.

CLYDE H. BRITTEN is now associated with the Lubri-Zol Corp., Cleveland. He was formerly manager of product application and development, Shell Oil Co., Inc., San Francisco.

Formerly assistant chief engineer, **DAVID L. GUNDRY** is now chief engineer of the motor truck section of Ward LaFrance Truck Division, Great American Industries, Inc., Elmira Heights, N. Y.

ROBERT DUNN is now assistant to the general sales manager of Macmillan Petroleum Corp., New York City. He was formerly eastern district manager of the same company.

Formerly a student member of the University of Minnesota, **MATTHEW A. SUTTON** is now an ensign in the USNR and is stationed on Guam.

C. L. DANTZER, formerly design engineer at the Paramount Engineering Co., is now senior design engineer in the Automotive Body Layout Division of Fisher Body Division, General Motors Corp.

Formerly an engineer and junior designer with the L.G.S. Spring Clutch Corp., Indianapolis, Ind., **WILLIAM F. SHIRLEY** is now associated with the Wisconsin Axle Division of the Timken-Detroit Axle Co., Oshkosh, Wis.

M. A. LINDEMAN is now mechanical engineer with the Physical Research & Development Laboratory of the Sun Oil Co., Chester, Pa. He was formerly a mechanical engineer at the Naval Ordnance Laboratory, U. S. Navy, Washington, D. C.

Previously chief test engineer, Stout Research Division, Consolidated Vultee Aircraft Corp., Dearborn, Mich., **J. H. WALDNER** is now liaison engineer with the Kaiser-Frazer Corp.

Formerly in the inspection department of the Aviation Division of the Studebaker Corp., Chicago, **RUSSELL D. CHASE** is now service manager of the Studebaker Sales Co. of Chicago.

P. J. BRADY has been elected president and general manager of the Monterey Mfg. Co., Los Angeles. He was formerly president and general manager of Pacific Aviation, Inc., same city.

Formerly field engineer, Continental Motors Corp., Detroit, **MILTON S. BALD** is now liaison engineer with the Hudson Motor Car Co., same city.

PAUL B. BENNER is now supervisor of

earth moving equipment design, Caterpillar Tractor Co., Peoria, Ill. He was formerly staff engineer with the same company.

Formerly general foreman, Illinois Division, Bendix Aviation Corp., Chicago, **HAROLD C. WILSON** is now methods engineer with the Pennsylvania Electric Switch Co., Goshen, Ind.

JOSEPH F. MacCAUGHTRY is now the owner of the Cardinal Co. of Los Angeles. He was previously manager of the Automotive Division of the Longren Aircraft Co., Torrence, Calif.

Formerly an engineer with the American Bosch Corp., Springfield, Mass., **HOWARD H. DIETRICH** is now serving in a similar capacity with the Rochester Products Division of General Motors Corp., Rochester, N. Y.

EUGENE B. ETCHELLS is now project engineer with Chevrolet Motor Division of General Motors Corp. in Detroit. He was formerly assistant department head, M. E. 5, General Motors Corp., Research Laboratories Division, same city.

HERBERT C. EDWARDS has been named chief engineer of research and development of the Timken Roller Bearing Co., Canton, Ohio. Formerly he served as chief engineer of the fuel injection equipment department of the same company.

Formerly general plant manager of the Braden Winch Co., Tulsa, Okla., **WARREN H. EMMONS** has been named eastern regional manager of the same firm.

KENNETH F. BROOKS is now assistant vice-president of manufacturing of the Nineteen Hundred Corp., St. Joseph, Mich. He was formerly master mechanic with the same company.

Formerly master mechanic with the Waialua Agricultural Co., Waialua, T. H., **HOWARD L. OVERMAN** is now manager of the Hilo Branch of the A. F. Stubenberg Co., Hilo, T. H.

Formerly liaison engineer, Douglas Aircraft Co., Inc., Santa Monica, Calif., **CHARLES H. BRUNNELL** is now design engineer in the Bellows Division of the Cook Electric Co., Chicago.

FRED A. DIETZ, who had formerly been assistant chief test engineer in the Aircraft Engine Division of Packard Motor Car Co., Detroit, is now manager of the Packard Proving Ground in Detroit.

E. D. WILKIN, formerly assistant chief engineer with Salsbury Motors, Inc., Los Angeles, is now project engineer with McCulloch Aviation, Inc., same city.

Previously project engineer, Detroit Transmission Division, General Motors Corp., Detroit, **JOHN W. GREER** is now serving in a similar position with Ford Motor Co.

LAWRENCE E. BALCH has recently joined Eberbach & Son Co., Ann Arbor, Mich. He was formerly assistant chief metallurgist with the Superior Engine Division of the National Supply Co., Springfield, Ohio.

MERL F. MILLER has recently become associated with the Transport Motor Co., San Francisco, California distributors of Willys jeeps, cars, and trucks, in the position of service manager.

Formerly assistant project engineer, Aero-

products Division, General Motors Corp., Dayton, Ohio, **WARREN D. BERKLEY** is now project engineer with the Commonwealth Engineering Co. of Ohio, same city.

JAMES F. CHAPMAN, formerly chief inspector, is now director of research and test of A.C.F.-Brill Motors Co., Philadelphia, Pa.

Formerly in the electrical layout department of the Bethlehem Steel Co., San Francisco, **WILLIAM S. CROWELL, SR.,** is now claims adjuster with the Pacific Indemnity Co., Oakland, Calif.

Until recently chief automotive adviser, USAAF, Washington, D. C., **J. S. DAGILAITIS** is now fleet superintendent, American Brewery, Inc., Baltimore, Md.

Formerly technical assistant to the purchasing agent, **ROBERT V. BAXLEY** is now contractor's equipment sales engineer with the Detroit Diesel Division of General Motors Corp., Detroit.

JULES A. DEMONET is now editor-in-chief of *Indoor Comfort,* Detroit. He was previously production engineer and special technical assistant to the chief of the production section, tank branch, War Department, Detroit Ordnance District.

Formerly director of flying training, Grant Technical College, North Sacramento, Calif., **MAJOR JOSEPH N. RAYMOND** is now supervisor of military cadet instruction, State of California, Office of the Adjutant General, Sacramento.

E. V. LANSKY is now superintendent, Cameron Surgical Co., Chicago. He was formerly general foreman, Dodge Chicago Plant, division of the Chrysler Corp.

Formerly production engineer, **H. ALBERT JONES** has recently been named chief engineer of the H. L. Harvill Mfg. Co., Vernon, Calif.

JACK R. DOIDGE is now divisional manager of the United Petroleum Gas Co., Chicago. He was previously assistant to the district manager of Philgas Industrial Division, engine fuel section, Phillips Petroleum Co., same city.

Formerly product engineer, Sperry Gyroscope Co., Inc., Great Neck, L. I., N. Y., **CHARLES J. LEASENFELD** is now field engineer with the Metallizing Engineering Co., Long Island City, N. Y.

Formerly engine specialist with the Dade Drydock Corp., Miami, Fla., **CHARLES F. GRAFFLIN** is now owner and manager of Grafflin Marine Service, same city.

GERRY H. BACH is now a vice-president of the United Petroleum Gas Co., Chicago. He was formerly district manager of the Phillips Petroleum Co., same city.

Formerly power engineer, Salvage Disposal Division, Holabird Signal Depot, Baltimore, Md., **FRANK M. GORSUCH, JR.,** is now field property officer, Department of Commerce, City of Baltimore, Md.

Previously chief industrial engineer, Harry Ferguson, Inc., Dearborn, Mich., **HERBERT L. HORNBECK** is now factory manager of Draper Motor Co., Detroit.

HERBERT A. ROBERTS is now president and general manager of the Roberts Bros. Co., Washington, D. C., manufacturers of electrical and carburetor equipment and automotive, aviation, and marine supplies. He was formerly Washington representative for the Electric Auto-Lite Co., Toledo, Ohio.

E. F. NASON, who was formerly production contact engineer, Pratt & Whitney Aircraft Corp. of Mo., Kansas City, has recently joined the Elastic Stop Nut Corp., Union, N. J., as service engineer.

Formerly chief design engineer, Firestone Aircraft Co., Akron, Ohio, **BYRON H. SHINN** is now associated with G & A Aircraft, Inc., Willowgrove, Pa.

R. J. PIETSCHMANN, JR., has recently joined the Sound Scriber Corp., division of J. H. Conrow, Inc., New York City, as sales and service engineer. He was formerly senior instructor and field service representative, Curtiss-Wright Corp., Propeller Division, Caldwell, N. J.

E. A. STOUT has become plant manager of the Duncan & Son Battery Co., Los Angeles, a recently formed storage battery manufacturing firm. Mr. Stout was, prior to this association, research and development engineer with the James H. Knapp Co., Inc., same city.

Formerly production engineer, Wright Aeronautical Corp., Lockland, Ohio, **ROBERT G. BREITENBACH** is now associated

with the Monroe Supply Co., Cincinnati, Ohio, where he is engaged in the manufacture and sale of industrial and domestic supplies.

VERN C. MARKLEY, JR., has recently joined Graham-Paige Motors Corp., Detroit, and is working on farm tractors and farm equipment. He was formerly project engineer with Harry Ferguson, Inc., Dearborn.

IRVING H. JUDD, who had formerly been administrative engineer, U. S. Army, Cincinnati Ordnance District, is now plant engineer with Emery Industries, Inc., same city.

J. N. JOHNSON has been elected president of Johnson Motor Lines, Inc., Charlotte, N. C. He was formerly director of the Southern Division of Associated Transport, Inc., Burlington, N. C.

Formerly an engineer in the development department, Fisher Tank Section, General Motors Corp., Detroit, **R. B. BURTON** is now serving in a similar capacity in Product Study Section No. 2 of General Motors.

Previously tool engineer in the Turret Division of Briggs Mfg. Co., **MAURICE A. BRISCOE** is now the owner of the Village Camera Shop, Detroit, which specializes in the sale and service of photographic supplies and equipment.

Previously chief engineer, Ross Engine & Equipment Co., Wichita, Kans., **R. S. WILLIAMS** has recently become a project engineer with the Aero Parts Mfg. Co., Inc., same city.

ROBERT O'HANLON has joined Menasco Mfg. Co., Burbank, Calif., as a development engineer. He was formerly supervisor of test development, Lockheed Aircraft Corp., same city.

Formerly an aeronautical engineer with Douglas Aircraft Co., Inc., Park Ridge, Ill., **D. W. DREAMER** is now an engineering designer with the Santa Monica, Calif., branch of the same firm.

HAROLD M. KING is being transferred to Germany to take part in engineering work in connection with the activities of the Technical Service Forces in the European Theater. He was formerly senior radio engineer, U. S. Army Office, and chief signal officer, Signal Corps, Washington, D. C.

Formerly general superintendent of production in the Armored Tank Division of the Chicago branch of the Pressed Steel Car Co., Inc., **H. C. BUNNIN** is now plant manager of the McKees Rocks, Pa., branch of the same company.

Formerly supervisor of production tests, Andover Motors Corp., Elmira, N. Y., **DONALD W. SMITH** has recently joined Kaiser-Frazer Corp., Willow Run, Mich.

EARL ARTHURS has formed his own company, Arthurs & Associates, business consultants and manufacturers agents, with offices in Charlotte, N. C. He was previously sales manager in the Bearing Division of P. R. Mallory & Co., Indianapolis, Ind.

Formerly regional manager, Bendix-Westinghouse Automotive Air Brake Co., Elyria, Ohio, **A. VANCE HOWE** has recently become branch manager of the Fruehauf Trailer Co., Columbus, Ohio.

Previously junior test engineer with the Arma Corp., Brooklyn, N. Y., **THOMAS F. WARDLE** is now assistant engineer with Western Electric Co., Kearny, N. J.

C. O. SLEMMONS has become chassis design engineer with the Studebaker Corp., South Bend, Ind. He formerly served as manager of rubber track development with the B. F. Goodrich Co., Akron, Ohio.

OBITUARIES

E. J. W. Ragsdale

E. J. W. Ragsdale died of a heart attack Sunday, Feb. 24. Colonel Ragsdale was chief engineer of the Railway Division of the Edward G. Budd Mfg. Co., Philadelphia.

A native of California, at the age of 12 he went to China where his father was consul-general for the United States. He spent some time in Germany studying at technical schools and later came to the United States where he attended M.I.T. After his discharge from the Army in World War I, he joined the Budd Mfg. Co., and had served with it practically ever since.

first in the capacity of research engineer and later as chief engineer of the Railway Division. Holding about 140 patents, Colonel Ragsdale was the inventor of the Shotweld system, which has made possible the widespread use of stainless steel.

Hans Wollner

Hans Wollner, assistant chief engineer, Vinco Corp., Detroit, died recently at the age of 48. Before joining Vinco Corp., Mr. Wollner was tool design checker with Graham-Paige Motors Corp. For one year prior to that he was assistant to the manager of the Berlin, Germany, plant of the same company.

He became a member of SAE in 1930.

Carl C. Ottoson

Carl C. Ottoson, assistant chief of the Motor Equipment and Maintenance Department of the City of New York, died recently at the age of 49.

Mr. Ottoson first joined the Sanitation Department of the City of New York in 1924, and since that time had served with several companies in Metropolitan New York as automotive and design engineer. In 1934 he rejoined the Department of Sanitation, with which he served as an automotive designer until his appointment to the motor equipment and maintenance department.

Mr. Ottoson was elected to member grade in SAE in 1942.

John P. Stein

John P. Stein, secretary, treasurer, and manager of Dependable Tank Transport, Inc., Seattle, Wash., died recently. He was 48 years old.

He had been associated with Dependable Tank Transport, Inc., since 1936. Prior to that he was connected with the Petroleum Transport Co. Mr. Stein joined SAE in 1941.

William R. Werther

William R. Werther, assistant chief metallurgist, Algoma Steel Corp., Ltd., died Feb. 4 at the age of 60.

Born in Johnstown, Pa., Mr. Werther attended King's College in Nova Scotia and Queen's University in Kingston, Ont., Canada. He first became associated with the Algoma organization in 1911 while he was still attending school. In 1915 he was appointed chief chemist of the firm. He became assistant chief metallurgist in 1939. Prior to joining the Algoma Steel Corp., he was a chemist with the Dominion Iron & Steel Co. in Nova Scotia.

Paul H. Winter

Paul H. Winter, production manager, Rogers Diesel & Aircraft Corp., New York City, died Jan. 23 at Doctors' Hospital at the age of 48.

After attending Purdue University, he joined the Garford Truck Co., Lima, Ohio, as a draftsman in 1920. From 1932 to 1934, he owned and operated the Truck Service Co., Scranton, Pa. He was sales and service engineer with the E. R. Merrill Spring Co., New York City, prior to joining the Rogers Diesel & Aircraft Corp.

Mr. Winter became a member of SAE in 1943.

SAE VETERANS AVAILABLE

Following are briefed experience records of SAE veterans of World War II who are seeking employment through the SAE Placement Service. Interested employers are invited to address inquiries by number to SAE Placement Service, Society of Automotive Engineers, 29 West 39 St., New York 18, N. Y.

4789 Automotive Fleet Engineer, 43, 20 yrs. varied experience in operation of large motor truck fleets. Thoroughly experienced in shop practices, preventive maint., purchasing of parts and equipment, replacement and standardization programs, cost accounting and training of mechanics and drivers, safety work. Resident – Va., location open.

4902 Grad. of Aero. Engrg. School, 24, desires a job with an aircraft factory in Met. N. Y. area. 2 yrs. stress analyst on helicopters, 2 yrs. USAAF helicopter specialist. Resident – N. Y. C.

5037 Automotive Engineer, 52, honorably discharged U. S. AAF Jan. 1, 1945,

after serving overseas as Major and Lt. Colonel, experience in research, lubrication, as mgr. of sales petroleum co., super-service stations; can handle fleet operation, take complete charge of shops and can handle men. Available immediately. Resident – Chicago, location open.

5039 Prod. Engr., 37, experienced in aircraft engine maint., working for Army Air Depot, discharged soldier World War II, 10 points preference with Civil Service Comm., foreign languages French and German, available now. Resident – Utah, location preferred – East or Europe.

5096 Transp. Engr. and Supt. of Automotive Maint., 56, experienced heavy duty equipment both diesel and gasoline powered, has had wide experience in field inspections, also setting up and teaching in automotive schools. Speaks French and German. Will consider foreign service. Army service. Has had charge of large shops, maint. of all types of motor cars and trucks for manufacturer, dealer and fleet owner. Resident – N. Y. C., available immediately.

5099 Mechanical Engineer, 27, experienced in aircraft engine and spark plug testing and general aircraft inspection. Now in Army, desires maint. engrg. position with an airline. Will accept U. S. or foreign location. Resident – Pa.

5102 Young Grad. Aero. Engr., 26, with 3 yrs. experience, desires engrg. position involving coordination of design, tooling and prod. depts. Discharged veteran AAF. Willing to undertake advanced schooling in preparation for possible future executive position in organization. Has completed one yr. grad. work in business adm. Resident – Ohio, prefers New England or Midwest location.

5127 Fleet Operation, Maint. and Service Supt., 48, wide experience in truck transportation, also heavy equipment such as road equipment and cranes. Recently discharged U. S. Navy "Seabees" after 2 yrs. in South Pacific Islands. Resident – Calif., location open.

5132 Grad. Aero. Engr., 30, experience in aircraft engine installation, prod. engine testing, engine experimental engrg. and wind tunnel testing. Desires position in prod. engrg. with opportunities in prod. management. Resident – Penn., location open.

5133 Aero Engr., 45, married, dependent, lawyer, admitted legal practice 12 yrs., grad. Naval Engineer, 8 yrs. experience mostly aeronautical; BS, LLb. Naval Eng. JSDr.; supervisory experience in research, design, electric, physical and hydraulic testing, magnetos, highly precision equipments. Quality control organizer. Desires position with airline and/or where legal and engrg. knowledge and experience both useful. Released USAAF Sept. 30, 1945, also served in World War I as test pilot (flying boats). Resident – N. Y. C., prefers N. Y. or foreign location.

5134 Aero Engineer, 31, 8½ yrs. experience in airline, aircraft engine co., aircraft co. and Army Air Forces, desires permanent connection in aeronautical industry or engrg. sales. Resident – Calif., location open, foreign considered.

5157 Service Mgr. or Sales Service Engr., 39, 12 yrs. experience for mfr. of industrial engines (gas diesel) automobiles, trucks, marine engines, tractors, road building equipment or allied automotive equipment. Resident – Detroit, prefers Midwest location.

5165 Naval Officer, 40, ME and MME degrees, available soon, 20 yrs. experience gasoline and diesel engine development, research, motor coach fleet operation, executive ability, lab. direction. Resident – L. I., prefers L. I. or Met. N. Y. location.

5186 Navy Test Pilot, 29, 8 yrs. aero. design and flying experience, ME degree. Desires sales engrg., contact, dev. or test work. Will travel anywhere. Available immediately. Resident – Penn.

5205 Sales or Service Promotion, grad. ME, 42, recently Captain Marines, desires connection with car, truck or parts manu. or major oil co. 20 yrs. experience. Location open, available immediately, resident – N. Y.

5216 M.E. Grad., M.I.T., 26, former Naval officer, experience toolmaker, has held CE and Prod. Mgr. positions in metal fabrication and assembly. Available immediately. Resident – N. Y., location open.

5217 Tool Process Engineer, 30, married, veteran Army Air Forces, physically fit, 10 yrs. wide practical experience tool and gage

mfg. and inspection. Available immediately, resident – Mich., prefers Detroit area.

5218 Industrial Engineer, General Foreman, Prod. Mgr. or Supt., 43, Army officer (Major), transferred to inactive duty, 20 yrs. experience in machine tool field, in handling and supervising personnel. Best of character. Available immediately. Resident – Va., location open.

5219 Production Engineer 33, grad. EE, 7 yrs. experience supervising manu., prod- and inspection of automotive parts, 4 yrs. as project and liaison officer on tracklaying vehicles for Ordnance Dept. Resident – Mich., location open.

5242 Experimental Engineer, 34, 10 yrs. experience, now Major Ordnance Dept., desires supervisory position in automotive engine dev., sales engrg. or accessory fields. Available now. Resident – Detroit, prefers Conn. or Detroit location.

5256 Research & Dev. Engr., 24, married, 6 yrs. varied experience in designing and dev. of diesel engines and accessories. Experience includes gas turbines and superchargers. Capable and experienced in project planning and supervision. Desires position with progressive firm. Resident – N. Y. C., prefers Met. N Y. location.

5262 Mech. Engr., 23, former Air Corps Engrg. officer, 3 yrs. experience in design, plant and aircraft maint., shop processes, field work. Desires machine design, prod. dev. or plant maint. position. Resident – N. Y. C., prefers Met. N. Y. or New England location.

5268 Mech. Engr., 35, Master's degree, with 1 yr. experience in diesel fuel injection research; 6 yrs. experience as field engineer for prominent industrial consultant involving cost reduction programs in diversified industries through better methods, equipment, plant layout, etc.; served 4 yrs. as Captain, assigned to Office of Chief of Ordnance – Detroit, Dev. Div., as Project Engineer and carried through to completion 14 major vehicle dev. projects. Released from Army Dec. 31, 1945. Desires responsible position in progressive co. as Industrial Engineer, Dev. Engr. or Sales Engineer. Resident – Mich., location open.

5271 Research and Test Engineer, Army officer, 27, available soon, BS ME and ME grad. courses, 5 yrs. engine experience. Possesses civilian and Army (Proving Ground Command) experience, initiative and interest in aircraft type reciprocating engine and gas turbine dev. and testing work. Presently in chg. of large and important Air Corps engine investigating program. Desires permanent, responsible position with co. doing reciprocating engine or gas turbine research, dev., etc. Prefers Detroit location, otherwise open. Resident – Fla.

5276 Mech. Engr., Lt. USNR, 24, available now after completing 18 mos. post-grad. design engrg. course at U. S. Naval Academy, 2 yrs. naval experience supv. ship construction and machinery repairs, 7 mos. in test dept. of truck and bus manu. Especially desires position with future in prod. or sales. Resident – N.Y.C., prefers N.Y.C. location, otherwise open.

5279 Mech. Engr., 24, to be released from U. S. Navy, desirous of research in diesel engrg. or engrg. rep. in foreign countries (France, China). Good knowledge in French and Chinese. Schooled in diesel engrg. in Navy. Resident – N.Y.C., stationed in Colo., location open.

5285 Automotive Engr. Grad., M.I.T., 26, 4 yrs. experience in gasoline and diesel engines and gas turbine dev., research and service. Desires position in sales or sales-service. Available immediately. Resident – Mass., location open.

5287 Grad. Mech. Engr., 34, experienced in research and dev. in aircraft power plant and petroleum industries, desires position as executive engineer involving supv. and adm. of engrg. projects of an experimental character and in such capacity to direct the purchasing requirements and experimental investigations incident to the dev. Now serving as Lt. (s.g.) in U. S. Navy, to be released in spring, 1946. Resident – N. J., stationed in Wash., D. C., location open.

5288 Automobile Engineer, 26, ex-British Army officer, married, experienced in development and research work, wishes to contact American co. with view of coming to U. S. Would be prepared to be engaged for time being as European rep. Resident – London, England.

5296 Young Grad., M.E., 21, 1 yr. USMM, marine engrg. Desires machine design, prod. dev. or experimental work.

Speaks fluent Spanish and French. Resident – N.Y.C., prefers Met. N.Y. or New England location.

5298 Mech. Engr., 26, 3 yrs. aircraft maint. officer in Air Corps. Experience in supv. of aircraft and accessory overhaul shops. Desires aircraft or engine overhaul and maint.; aircraft or other internal combustion dev. and prod. Resident – N.Y.C., prefers N.Y.C. location, otherwise open.

5299 Fleet Maint. & Serv. Supt., 37, wide experience large automotive fleet maint. A-1 at preventive maint. methods and cutting operational costs. Also qualify as serv. mgr. experience, selling service, flat rate and time study. Understand handling personnel, especially mechanics. Army Quartermaster – civilian automotive instructor, teaching principles and repairs; Navy – district automotive maint. officer. Adviser maint. procedures and problems, field inspector. Location open, resident – N.Y.C., available now.

5301 Mech. Engr., 25, 4 yrs. AAF and civilian supervisory experience in aircraft and engine maint. Prefers position involving research or project development. Now in Army, will be out shortly. Resident – Chicago, prefers West or Midwest location.

5302 Executive; Auto and Transp., 40, married, grad. EE, inactive officer just completed 2 yrs. as Transp. Officer in China and 3 yrs. Chief Exec. Automotive Training School. Previous experience as executive engineer 6 yrs. design, test, and application of automotive brakes and 4 yrs. design, test and application elect. equipment. Resident – Georgia, prefers southern location, otherwise open.

5304 Mech. Engr., 25, veteran Air Corps Engrg. Officer, general experience with small arms ordnance in prod. and for the Army; 2 yrs. experience as design and dev. engineer on AAF equipment. Particularly interested in industrial electronic controls. Available immediately. Resident – N.Y.C., prefers N.Y. area, otherewise open.

5306 Aero Engr., 29, BS in AE, 4 yrs. drafting and stress analysis, 5 yrs. Air Corps procurement, one yr. project officer on cargo airplane, Wright Field and supv. experience. Desires sales or leading to sales. Resident – Calif., prefers West or East Coast location.

5315 Grad. Aero. Engr., 30, 3 yrs. Naval aircraft maint. officer, 6 mos. liaison engineer aircraft mfg., 2 yrs. layout and design aircraft components, 3 yrs. automotive mechanic. Desires sales and service work. Resident – Maine, location open.

5316 E. E., Executive or Adm., 31, 10 yrs. experience electronics, servos, aircraft and industrial controls, aircraft ignition, sales engineering. Qualified in automatic temperature controls, propeller pitch controls and automatic pilots. Previous positions: Head of Research Lab., Central Office Engineer, Asst. CE, CE. Capable of directing activities and handling men. Resident – N.Y., prefers N.Y. area.

5318 Service & Sales Engineer, 38, MS in ME, recently Lt. Navy technical air intelligence, 2 yrs. analyzing aircraft equipment, 5 yrs. experience analyzing and overcoming service difficulties and sales resistance in diesel engine and automotive equipment field. 5 yrs. technical instruction and preparation maint. manuals. Resident – Calif., prefers Calif. location.

5319 Mech. Engr., 29, honorably discharged from Ord. Dept., U. S. Army. Served 6 yrs. testing ordnance automotive equipment. Desires engine installation engrg., sales or service engrg. Resident – Md., location open.

5332 M.I.T. Grad. M. E., 36, Lt. Comdr., 12 yrs. experience diesel engine, truck, bus, gear, vibration, strain gage testing, desires position in vicinity of N.Y. Resident – N.Y.

5333 Mech. Engr., 26, 2 yrs. aircraft engine prod. and dev., 2 yrs. diesel, gasoline engine & electrical operation, maint. and repair. Desires development, service or sales, internal combustion or petroleum field. Resident – Ga., available May 1946, prefers Southwest location, otherwise open.

5337 Mech. Engr., Grad., 23, married, 2 yrs. experience, 1 yr. post-grad. study in Automotive Engrg., now Naval Officer, desires sales/or service engrg. position. Available May, 1946. Resident – N.Y., stationed in Penn., location open.

5346 M.E. Grad., Cal. Tech., 24, married, former Naval Officer. 2 yrs. Navy Yard experience in planning and prod. divisions involving ordnance installation, repair and maint. Available immediately. Resident – Los Angeles, prefers Los Angeles area.

5347, Mech. Engr., 27, married, BS in ME, 2½ yrs. experimental dept. aircraft engine co., 3 yrs. Lt. Marine Corps aircraft engine trouble shooting. Desires experimental engine dev. work, aircraft or automotive. Available now. Resident – Va. location open.

5348 Ex-Navy Chief, 34, with 11 yrs. experience in diesel and steam field wishes to get with major firm or activity on research and development field with internal combustion units coming into post-war field. Resident – Detroit, prefers Mich. or Seattle, Wash., location.

5349 Aeronautical Engineer 30, presently with Bureau of Aeronautics, Power Plants Design Div., desires position in dev. of high power aircraft engines – conventional, diesel or jet types. Resident – Md., prefers Wash., D. C., location.

5354 Sales, Promotion or Consumer Research, 30, single, desires connection with truck or trailer manu. 15 yrs. association with trucking field. 10 yrs. as operator and mechanic, 5 yrs. as mgr. of concern doing heavy hauling. Has designed and built specialized semi-trailers. Desires position involving responsibility, contact work with customers and chance to work out some ideas on trucks and equipment. No degrees or licenses, only practical experience. Schooling includes 1 yr. college, all courses science. Resident – Pittsburgh, Pa., location open, available 15 days.

5356 Mech. Engr., 29, MS Purdue (1940), exp. army and industrial supv. 6 yrs. engine research, test and maint. on gas and diesel engines, including radial, railway, marine and stationary engines. Some design experience and cost accounting. Languages – Dutch, German, French. Desires research and dev. Resident – N.Y.C., location open.

5357 Mech. Engr. Grad., 25, married, 4 yrs. experience in aircraft engine test, performance, development and flight work; now Naval Officer, desires opportunity to enter industrial management phase of engrg. Available April 1946. Resident – Conn., stationed in Penn., location open.

5358 Grad. Mech. Engr., 26, married, desires position with a future. Honorably discharged veteran with over 3 yrs. service in the AAF as aircraft engrg. officer. Experienced in aircraft engine and automotive engine research. Resident – Detroit, available at once. Prefers Detroit location.

5359 Mech. Engr., 30, 4 yrs. Army construction equipment maint. Prefers experimental or dev. work on internal combustion engines. Thorough knowledge of machine shop practice. Grad. M.I.T. Available now. Resident – Mass., prefers New England location.

5361 Fleet Maint., & Shop Supt., 53, A-1 at preventive maint. methods and cutting operational cost. Past 12 yrs. setting up automotive shops in U. S. Army QM and Ordnance Dept. on prod. line basis with their respective supply systems and also qualify as service mgr., experienced in selling service, flat rate and time study, understands proper method of handling personnel, adviser on maint. problems and procedures. Attained rank of full Col. Ord. Dept., had efficiency rating of 48.8 out of possible 50 upon being released from Army. Available now. Resident – Calif., location open.

5363 Grad. ME, 25, former Air Corps Maint. Engr. Officer and Technical Inspector, 1½ yrs. experience in aircraft maint., 1 yr. tech. inspector and 10 mos. jr. methods engr. Desires research and dev. in automotive engrg. Available immediately. Resident – Ill., location open.

5365 M.E., 27, single, 5 yrs. diversified experience including aircraft design and test, tooling, machine design, power plant oper. and field service. Desires opportunity with small co. as sales rep. Resident – N.Y.C., location preferred – Calif., otherwise open.

5366 Chief Draftsman, 28, NYU grad., 5½ yrs. experience detailing, layout, checking, designing, processing, experienced in establishing drafting room standards, routine, etc. Brake design specialist, fine background in tool and gage design and prod. methods. Resident – N.Y.C., prefers N.Y. or Calif. location.

5367 Mech. Engr., 24, Cal. Tech. 1943, 1 yr. experience in aircraft prod. design and technical writing. Naval training in electronics. Desires prod. engrg. position in

aircraft. Resident – Calif., prefers S. Calif. location.

5368 Air Forces Major, on terminal leave, 32, grad. Aero. Engineer with Mechanical option, seeks automotive original equipment lines. Has 12 yrs. sales engrg. experience, last 4 with services and automotive aircraft manufacturers. Resident – Mich., prefers Detroit area.

5369 Mech. Engr., 28, grad. Purdue Univ., recently discharged Major, Staff Automotive Officer, Ord. Dept., experienced prod. control, job analysis, inspection, test and supply. Desires position in prod. engrg. with automotive manu. Available April 1946. Resident – N.Y.C., prefers Midwest location.

NEW MEMBERS Qualified

These applicants who have qualified for admission to the Society have been welcomed into membership between Feb. 10, 1946, and March 10, 1946.

The various grades of membership are indicated by: (M) Member; (A) Associate Member; (J) Junior; (Aff.) Affiliate Member; (SM) Service Member; (FM) Foreign Member.

Baltimore Section: Garth L. Bair (M), Peyton M. Magruder (M).

Buffalo Section: D. R. McRitchie (M).

Canadian Section: J. W. Primeau (A).

Chicago Section: William C. Jackson (J), Robert Stevens Johnson (J).

Cincinnati Section: Gilbert F. Broden (M).

Cleveland Section: L. Eugene Baughman (J), Irving Bradley (J), Russell L. Dobrin (J), Richard A. Hartman (A), W. S. Kidder (A), Clayton McKrill (A), Robert D. Pae (J).

Colorado Group: George E. Martin (A).

Dayton Section: Capt. George P. Johannes (A).

Detroit Section: Edward F. Collins (M), Wilfred R. Fox (A), Morris R. Graham (M), Richard E. Karvonen (A), Paul Kuhn (J), Jack Dean McCullough (J), Kenneth T. Millspaugh (M), Harold W. Small (A), Fred P. Van Dame (J).

Hawaiian Section: James Monro (A).

Indiana Section: Eugene Elmer Hess (J).

Metropolitan Section: Harold A. Batzold (M), Henry Berman (J), Eldred R. Crow (A), John R. Griffin, Jr. (M), Robert R. McCoy (J), Jerome Vegosen (J)

Milwaukee Section: Richard D. Cory (A).

New England Section: Charles H. Meeker (A), R. H. Rilee (A).

Northern California Section: Judson Hayden Pickup (A), Harold D. Stromberg (J), Ernest L. Winkler (A), Robert George Whitney (J).

Northwest Section: Clifford E. Plouff (J).

St. Louis Section: Meredith W. Druif (A).

Southern California Section: David C. Eaton (J), Ronald E. Eggert (A), Fred O. Hosterman (M), William F. Hoy (J), Wendell Archie Hubbell (A), M. G. McKinney (A), Ross Edward Morrow (A), H. B. Robison (J), James M. Smith (J), Ralph H. Swaisgood (M).

Southern New England Section: Herbert E. Pike (A).

Syracuse Section: Joseph A. Mehlek (A).

Texas Section: A. V. Tice (A).

Virginia Group: Robert P. Knighton (A), John Hampden Smith, Jr. (J), Charles W. Tucker (A).

turn to p. 50

APPLICATIONS Received

The applications for membership received between Feb. 10, 1946, and March 10, 1946, are listed below. The members of the Society are urged to send any pertinent information with regard to those listed which the Council should have for consideration prior to their election. It is requested that such communications from members be sent promptly.

Baltimore Section: Harold D. Duppstadt, Leonard S. Moore.

Buffalo Section: Edward C. McDonough.

Canadian Section: George O. Clermont, Sydney G. Fearman, Hess Finestone, Ralph Gruber, William H. Maybee, Sydney R. Skelton, Clifford Alton Rourke, David R. Thom.

Chicago Section: A. H. Kerndt, Albert E. Kraus, Howard E. Paulson, John W. Trimble.

Cleveland Section: Walter A. Alaska, Frank Calvin Bayer, Leonard C. Fisher, William R. Galloway, Morton H. Golder, Louis F. Held, W. W. Halstead, Richard B. Proudfoot, Paul H. Richard, Richard J. Schager, Arthur H. Schweitzer, Leonard F. Thunhorst.

Dayton Section: George O. Gale.

Detroit Section: Samuel B. Allen, William T. Baxter, Willard G. Beattie, David Bessie, Layton E. Bury, William H. Collman, Howard B. Dickie, Bruce M. Dunham, Fred W. Grant, William E. Harrison, James M. Hart, Ralph B. Hayne, Robert H. Hilker, James F. Hoffer, Norman A. Holly, Gerald W. Hostetler, Everell Willis Jewett, Jr., Joseph P. Kalivoda, Lloyd E. Kamm, J. Robert Lakin, Dean E. Leffler, J. Weller Loveday, George K. Malone, Hans A. Matthias, James Alvin Miller, Byron Montgomery, John J. Morrow, Edward B. Northrup, Carl F. Ostrosky, Robert M. Palmer, George S. Raeder, Harry M. Ramsay, James Rayer, Howard A. Reed, James W. Schiefer, Harold Schmidt, James W. Shank, Frederick R. Steese, Burton E. Tiffany, Donn K. Tippy, William H. Wanderer, James Edward Warrick, Edward A. Wheeler, Harold C. Williams.

Indiana Section: Edgar George Davis, Gerald C. Ollis, George E. Zorini.

Kansas City Section: John R Gross, Clarence E. Meyer.

Metropolitan Section: Dudley C. Adamson, Roland Christian Bergh, Alfred F. Bottaro-Lopez, Ward H. Brigham, William Edwin Burns, Thomas F. Cannan, Benjamin J. DeSimone, Leo F. Donnelly, Walter J. Doran, Irwin Fein, William A. Gardner, Paul Robert Gley, Frank J. Graf, Douglas Keator Griffin, Arthur P. Gluck, I. S. Hall, Robert Edward Homa, Jay Jonas, Robert G. Kaiser, George M. Kohler, Jr., Albert Lake, Harold S. Lang, Paul Wilson Leak, Frank Maizel, Joseph J. Malone, Francis M. McAvoy, Willard Chalmers McMullen, Edward Dewitt Meeker, Joseph M. Mergen, Arthur F. Moricca, Lester E. O'Brien, Harold K. Paiton, William Prince, Edward Joseph Sand, Charles Robert Schreiber, Jr., John J. Shuttleworth, Donald James Stroop, William B. Tiefenbacher, Gilbert John Till, Mirabeau C. Towns, Jr., Elwood C. Walker, John L. Weiler, Henry B. Whitman, Don R. Woolf, Philip J. Yunker.

Mid-Continent Section: Delton A. Frey.

Milwaukee Section: George Franklin Bastian, Joseph Haban.

Mohawk-Hudson Group: Wesley C. Baylis, D. Frank Hayes, Jr.

New England Section: Mt. Sgt. John F. Hart, Lt.-Col. Allan L. Harts, George A. Gardner.

Northern California Section: Al Menzmer, Paul Clifford Perry, Lt.-Col. George W. Rogers, Hans Warkentin.

Northwest Section: Dan P. Cheney, F. B. Harwood, George W. Marshall, Richard H. Norton, Paul J. Ruple, Howard Charles Tinney.

Oregon Section: Glenn W. Snook.

Philadelphia Section: Dale Ernest Kistler, Gerald von Stroh II.

Pittsburgh Section: A. Wayne Gordon, A. W. MacLaren.

St. Louis Section: Frederic L. Matthews, Howard M. Parkes.

Salt Lake City Group: Dean C. Despain, Dean Edward Kellerstrass.

Southern California Section: Don W. Driskel, Charles J. Eckenroth, William Ellis Kavasch, Richard Warren Lawton, Austin Clinton Porter, Bruce Orville Todd, Vard, Inc., Charles W. Yaeger.

Southern New England Section: Capt. Herbert W. Kieffer, Seth Haines Stoner.

Spokane Group: Donald Ernest Majer.

Syracuse Section: Richard A. Butcher, Philip R. McGinnis, Cyrl Waldie Terry.

Twin City Group: Edward M. Baltuff, Jr., Waldo H. Kliever.

Virginia Group: James William Ra[illegible] kin, W. P. Sims.

Washington Section: Ferdinand G[illegible] Brickwedde, William George Harsha[illegible] John King, James Jensenius Myers.

Wichita Section: Stanley James Ba[illegible] George E. Harris, Clyde V. Lassmann, Jo[illegible] Wallace.

Outside of Section Territory: Howard A. Kirsch.

Foreign: Michael B. Ashman, England; Arthur Capella, England; David James Colquhoun, Australia; Mohamed Mostafa El Alaily, England; Czeslaw Kapica, England; Bjorn Oscar Kjellberg, Sweden; Percy Morrey, England; Andre Ruegger, France.

New Members

cont. from p. 48

Washington Section: August Altiery (A), Capt. John Fitz Hill (J), Kenneth Weston Winsor (J).

Western Michigan Section: William Henry Kennedy (M).

Wichita Section: Von Leroy Morton (A).

Outside of Section Territory: Arthur Dawe (A), Walter J. Kish (A), Claude M. McCue (M), Harry John Pellerin (A), Gordon E. Smith (A), Rae C. Stevens (J).

Foreign: Capt. R. P. Hamilton Ash (J), India; Arthur Edward Laurence Collins (FM), India; Cyril Leonard Edwards (A), England; Aage C. Jensen (FM), Denmark; John Dudley North (FM), England; Pierre Prevost (FM), France; John J. Roitt (J), England; Dr. Aly M. Shoeb (FM), Egypt; Keith Livingstone Swift (J), Australia; Percival Edward Thomas (FM), England.

cont. from p. 33

Scientific Methods Refine Depreciation

Excerpts from paper

by HOWARD L. WILLETT, JR.

Willett Co.

■ Annual Meeting, Jan. [illegible]

(Paper entitled "The 'For Hire' Carrier Looks at Depreciation")

DEPRECIATION is supposed to write off a piece of equipment so that when the vehicle is ready for replacement you have your original investment returned. If the method of depreciation is accurate you will come out even. However, operating conditions vary greatly, and a depreciation method that would get you your money back from one operation would not necessarily suffice for another.

We depreciate the truck, the tires, and the body, if detachable, separately and according to usage. We consider depreciation as a fixed weekly or yearly charge,

based on a number of factors such as high maintenance after a certain mileage, obsolescence and so on.

Depreciation is set on every vehicle by a committee consisting of the treasurer, general manager and the head of the maintenance department.

Treasurer sets up the rates which provide that the company get its money back from the investment in the truck. The operating department analyzes the problem of the use of the truck, and provides the information as to how far it will operate. Maintenance department then estimates how many miles the vehicle can operate at a fixed cost of maintenance per mile under those conditions, or the "useful life" of the vehicle before high maintenance sets in. Treasurer then sets up the depreciation at this rate.

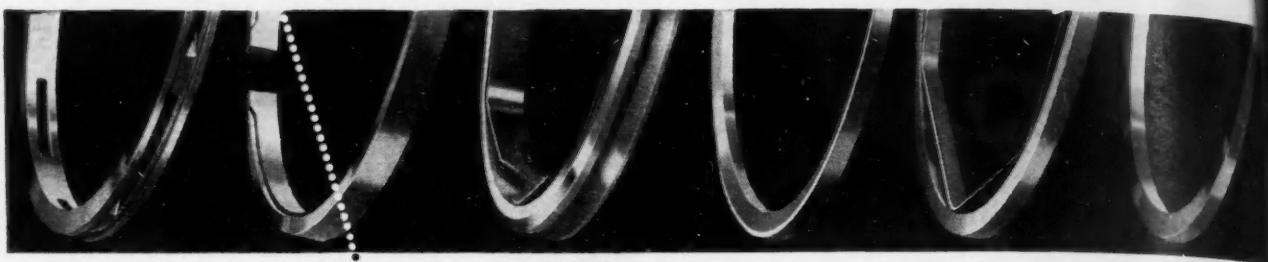
The big problem, however, is how long this truck should be run. When should it be replaced, and how soon should you get your investment back and buy a new truck? There are two schools of thought on this subject as illustrated by Oliver Wendell Holmes and the Canadian woodchopper. The "Wonderful One Hoss Shay" "went to pieces all at once"—had very low depreciation and maintenance and no trade-in problem. On the other hand, a French Canadian Lumberjack expressed the poorest depreciation policy: "By Gar," he said, "this is one beutiful axe—she never wear out. In the last two season I only have to buy three handle and two head." During the past few years this is what we have been doing to our trucks.

The compromise we have to make is somewhere as close to Mr. Holmes as possible, without getting into the same trouble as our lumberjack friend.

For small vehicles, the controlling factor will be high maintenance cost. High maintenance will set in on these vehicles after 80,000 miles. These trucks run about 50 miles per day or 15,600 miles per yr. Supposing the original cost to be $1000 without tires, and the residual value to be $100 without tires, we have $900 to be depreciated in five yr, or $3.46 per week. If this same vehicle is used at the rate of 75 miles per day, then it will have to be depreciated sooner.

Let us take a more complicated problem. Assume that a tractor is operating two shifts with a trailer, the combination going 250 miles per day. On some vehicles in this work, we estimate 250,000 miles as the useful life of the tractor before the maintenance becomes prohibitive, and five years for the trailer, with no reference to mileage. Thus, we would depreciate the tractor in 3 1/3 years and the trailer in five years, with a cost for the tractor of $4500 plus tires, and a residual value of $350. The tractor would then be $23.99 per week. If we assume the cost of the trailer at $3000 plus tires, the depreciation would be $15.40 per week. The highest mileage we use in depreciation is 400,000 on some special vehicles. Due to wartime lack of replacements we have run a number of vehicles considerably in excess of this figure, and, from a maintenance standpoint, are very sorry.

Each job must be treated separately. Depreciation factors are all estimates but we must have the best thought of the treasurer, operating department and maintenance department on each job to make these estimates.



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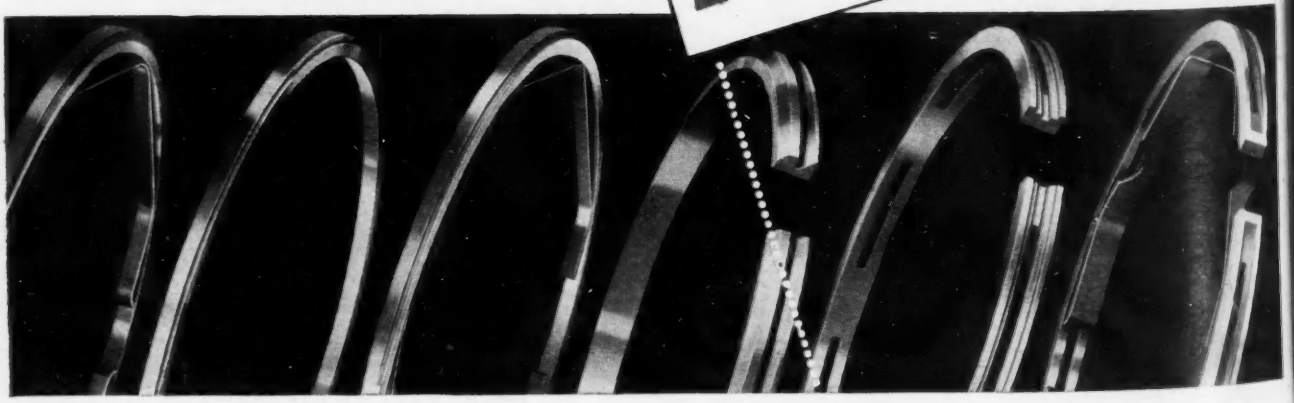

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